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Republic of the Philippines
OFFICE OF THE PRESIDENT

CEMENT INDUSTRY OF THE PHILIPPINES

PROGRAM IMPLEMENTATION AGENCY

REPUBLIC OF THE PHILIPPINES
OFFICE OF THE PRESIDENT
PROGRAM IMPLEMENTATION AGENCY

Industrial Project Development and Evaluation Office
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DRAFT

FOR COMMENT

THE CEMENT INDUSTRY
OF THE
PHILIPPINES

June, 1964

FOREWORD

This is the first of a series of industry reports containing information and analyses of economic data pertaining to selected industries.

This particular report is preliminary in nature since we feel that it will be desirable to get the comments and suggestions of individuals particularly those directly engaged or those who will be engaged with the cement manufacturing industry.

The report incorporates the analyses made on the different phases of an industry study which may have been completed. These different aspects include the Demand and Supply Analyses, Engineering Analyses, Financial Analyses, and Management and Ownership Analyses.

One of the major gaps in the formulation of industrial plans is the non-availability of a series of integrated analytical reports on industries in the Philippines. Industry reports are required by government agencies in the setting up of industrial policies as a guide to proposed legislative measures as well as for investment decisions. Financial institutions, both public and private, need industry reports in the evaluation of business projects presented to them for financing. Likewise, industrial companies, in planning new business projects or in expanding current production capacities will have to rely on industry reports.

This report does not claim to be exhaustive. Thorough analyses cannot be made at this time due to certain basic limitations, among which are the non-availability of desired data and reluctance of certain firms to give the information needed.

Reports and statistics of government offices, information gathered from direct interviews with officials connected with the industry, and plant visits helped a great deal in the preparation of this paper.

INDUSTRIAL PROJECT DEVELOPMENT
AND EVALUATION OFFICE

THE CEMENT INDUSTRY OF THE PHILIPPINES

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THE CEMENT INDUSTRY OF THE PHILIPPINES

SUMMARY

Number of Cement Plants – Six companies operating six plants produced portland cement in 1963 in the Philippines. Three plants are in Luzon and three plants in the Visayas. There were 2,406 persons employed in the industry last year.

Production – Starting in 1914 with an annual output of about 600,000 bags, the local portland cement industry grew gradually and increased its annual production to 6,900,000 bags by 1950. Thereafter, its production soared to record heights, registering 23,480,735 bags by 1963. The rate of growth is phenomenal compared to other local industries.

With a 10-year period to December 1963, Philippine production of portland cement rose by more than 315%. The average annual rate of increase in the last five years was 9.7% on both a tonnage and value of output basis.

Production of cement in recent years is shown below:

Year	Output	Percentage Change From Preceeding Year, %
1959	18,143,535	–
1960	20,745,489	+ 14.4%
1961	23,957,865	+ 15.4%
1962	22,422,000	– 6.3%
1963	23,480,735	+ 4.7%

The availability of domestic raw materials has assured the growth of the industry. Known reserves of limestone was 4,620 million tons (1963), while those of share are placed at 356 millions tons (1959). At present, gypsum is largely imported from abroad.

Demand and Consumption - Despite the industry's rapid expansion, it has not been able to keep up with the demand for its product, and the need to fill the gap has spurred considerable interest of new plants. The considerable expansion in demand came not only from the more traditional usage in non-residential construction, but also from the growing content of cement used in residential building. Demand for cement will still outstrip domestic production thru 1967, and offhand, the addition of more cement plant will be desirable.

Five additioanl plants with a combined capacity of 21,000,000 bags per year or about equal to the combined rated capacity of the 6 operating plants in 1963 are expected to operate during the next 2 to 3 years.

Financial - For 1963, the combined assets of the six operating companies increased by 10% over 1962. Total assets for 1963 was ₱140,139,100. Total value of sales in 1963 was ₱70,604,000 or 9% more than that in the previous year. The net profit after taxes in 1963 (except APO) was 11,199,000. Financial analyses indicate the excellent financial condition of the cement industry.

__General Problems__ - The 9.9 million bags deficit for 1963 is believed manifested in prevailing high retail price for cement. These retail prices may remain in their present levels unless more installed capacities and increased production is achieved in the next five years.

Studies have to be centered on the high unit costs of production which could be attributable to the high cost of fuel and power as well as the obsolescence of machinery and equipments.

The capacity growth of the industry will have to be dispersed geographically and away from the current areas of concentration.

__Long-Term Outlook__ - In modern times, one need only mention reinforced-concrete walls and griders, turnels, dams and roads to realise the dependence of present day civilisation upon the products. The long term outlook for portland cement is bright. There is at present much effort being exerted by cement companies to introduce a wider use of cement. The various techniques of reinforced, pre-stressed and precast concrete in non-dwelling construction, which could expand its share of the market at the expense of structural steel fabrication, will be an increasing important factor in supporting future demand. The growing use of concrete products in house building could also help to reduce the impact of fluctuations in demand from the major public utility type of construction.

With all the cement plants now in the pipeline and being planned, there will probably be room in the industry provided an efficient programming system is followed in the next ten years.

I. GENERAL

A. Identification of Industry

1. Description of the Industry

Cement plants together with establishments engaged in the manufacture of glass, ceramics, tiles lime and the like comprise the "non-metallic mineral product - industry" - industry 32 in the Philippine Standard Industrial Classification. Of the number of establishments in this particular industry, the majority are in the cement and glass products business.

2. Nature and Uses of Products

Portland Cement is well known as a basic ingredient in concrete. (The hard clinkers resulting from the burning of argillaceous limestone is known by the term portland cement to distinguish it from natural or pozzolana and other cements). This product when combined with proper proportions of gravel, sand, sawdust, asbestos, etc., in the presence of water, becomes strong, hard, weather-resistant concrete which has many uses.

3. Historical Background

The Philippine cement industry has a history going back 50 years. It saw its birth in the establishment of the Rizal Cement Company, Ltd. in 1914 at Binangonan, Rizal. This factory had a rated capacity of 2,000 bags per 24 hours. In 1919, it was forced to shut down due to its failure to produce cement of uniform quality. In July, 1928, the Madrigal and Company acquired the plant from Ynchausti y Compania to which it was sold by public auction in 1925. The plant resumed operations in 1930 and since that time it has operated more or less continuously except during the war when it suffered serious damage. Its present rated annual capacity is 6,000,000 bags.

The second plant was set up in 1922 at Naga, Cebu by the Cebu Portland Cement Company (CEPOC)a government entity. With an initial daily capacity of 4,000 bags, the plant expanded to 10,000 bags per day in 1940 and to 20,000 bags in 1950. The latter expansion was supported by a long term loan of ₱6,000,000 acquired from the Development Bank of the Philippines (then RFC) during the period 1948-1949. This plant was sold by the government to private investors (Apo Cement Corporation) in 1962. Rated capacity is now 4,000,000 bags per year.

The Philippine Portland Cement Co., Inc. was established at Guimaras Island, Iloilo on January 10,1949. The produce of this plant (with a rated capacity of 720,000 bags a year) is mostly sold in Panay and Negros Province.

The location of the fourth plant, established by CEPOC with a rated daily capacity of 8,000 bags, was in Bacnotan, La Union. This plant was turned over to the present management, the Bacnotan Cement Industries, Inc., on May 11, 1957. The acquisition of a third kiln this year has increased the plant's capacity from 4.1 million to 6 million bags per year.

In May 1957, another cement plant, established by the Republic Cement Corporation in Norzagaray, Bulacan, started operation. Due to its recent expansion program, the plant annual rated capacity is now 9,000,000 bags.

The most recent company that embarked in cement manufacture is the Universal Cement Co., Inc. in Dunguan, Danao City, Cebu. (This plant is not necessarily the newest plant since three new plants are either under test run or about to be completed). Rated capacity and production in 1963 were 3 million bags and 2.96 million bags respectively.

Five additional plants with a combined rated capacity of 21,000,000 bags per year are expected to operate during the next two-three years. The Mindanao Portland Cement Project, although completed in 1963, run into some technical problems. It is at present in the process of recapitalization and revitalization and is scheduled to start normal operation by June 1964. The Filipinas Cement had its test run in April 1964. San Jose Cement is uncertain to operate by 1965 for lack of operating capital.

The cement plant with rated capacity of 3 million bags and 6.6 million bags a year for the Universal Chemicals and Island Cement* respectively were included in the 8th reparation schedule as approved on April 20, 1964.

4. Firms in the Industry

There are at present six companies operating six plants in the country with 3 plants in Luzon and 3 plants in the Visayas. As previously stated, two more plants are expected to operate this year and three plants scheduled to operate in 1965-1966.

These figures differ very widely from those before the war or even before decontrol in 1949 when only 2 plants were in existence. The present combined capacity of these plants which will operate this year have become five time larger than that of 1941. The biggest change to occur in the cement industry during the last five years was the adoption of giant size production equipment. Some proposed plants are not only multiple-kiln factories but also will have 5 times more rated capacity than the average capacity of existing plants. This will boost the average production unit per plants

The geographical distribution of operating and proposed plant in the country is shown on the next page.

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* Island Cement withdrew its application from the Reparations Commission last May 1964.

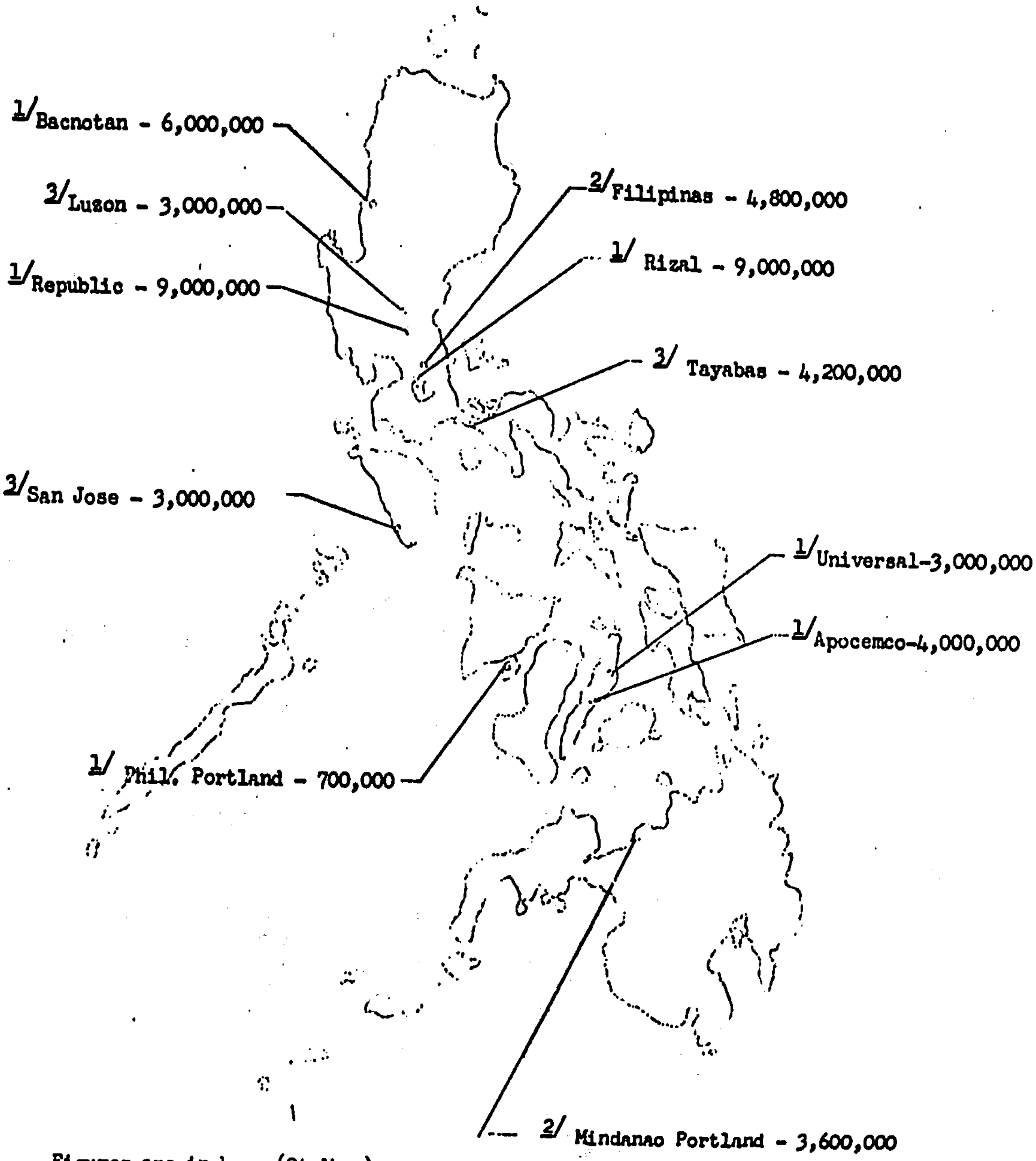
Name of Firms

	A. Operating Plants	Location	Start of Operation
1.	Rizal Cement Co., Inc.	Binagonan, Rizal	1914
2.	Apo Cement Corporation	Tinaan, Cebu	1922
3.	Phil. Portland Cement Co., Inc.	Guimaras, Iloilo	1949
4.	Bacnotan Cement Industries Inc.	Bacnotan, La Union	1954
5.	Republic Cement Co., Inc.	Norzaragay, Bulacan	1957
6.	Universal Cement Corp.	Danao, Cebu	1960
	B. Expected Additional Plants		
1.	Mindanao Portland Cement Corp.	Iligan, Lanao	1964
2.	Filipinas Cement Corp.	Teresa & Pasig, Rizal	1964
3.	San Jose Cement Corp.	San Jose, Mindoro	1966
4.	Tayabas Cement Corp.	P. Burgos, Quezon	1966
5.	Luzon Cement Corp.	San Ildefonso, Bulacan	1966

C. Possible Additional Plants

1. Atlas Cement (House of Investment & Koppers)
2. Island Cement (Cabarrus group) - Bulacan
3. Mayon Cement (Marbella group) - Albay
4. Universal Chemicals (Durano group) - Ilocos Norte
5. Davao Portland (B. Valendia group) - Davao
6. Garcia and Co. - Capiz
7. Superior Cement
8. Mabini Portland Cement (S. Pendatum group) - Mindanao
9. Quezon Portland Cement (Montenegro group) - Quezon
10. Century Portland Cement (Carlos group) Camarines Sur
11. Company X (C.C.C. group)

LOCATION AND PRODUCTION OF CEMENT PLANTS IN 1964



Figures are in bags (94 lbs.) per year,
Rated capacity

1/ Operated as of 1963 - 6 plants
2/ To operate 1964 - 2 plants
3/ To operate 1966 - 3 plants

B. Industry Problems

1. Marketing Problems

The combined installed capacity of the cement industry in 1963 totalled to 22,700,000 bags per year, a supply that was not sufficient to meet the country's requirement.

With the numerous plants proposed to be established within the next ten years, the government will have to be concerned with the direction of growth and with an efficient programming system.

With regards to the quality of production, local manufacturers have attained a degree of efficiency that makes the domestic cement competitive with imports even on a tax-free basis.

The distribution aspect for cement production will continue to be a seller's market in the years to come or until the supply can cope up with the increasing demand. As a matter of fact, proposals submitted by two advertising firms to promote increase use of cement were rejected. There was no use for this type of campaigning for the moment.

2. Technical Problems

One of the main problems of the industry has been its inability to reduce costs to a level comparable and competitive with that of Japan and Taiwan. Although the labor costs are admittedly relatively cheaper in this country, the high cost of fuel and power as well as the obsolescence of machinery and equipments have been largely responsible for the relatively higher cost of production.

It is desirable that the capacity growth of the industry be dispersed geographically. The erections of new plants away from the current areas of concentration have to be encouraged.

3. Financial Problems

Figures relating to the six operating plants as appearing on the Financial Analysis portion of this paper indicate the excellent financial condition of the cement industry.

The expansion of some of the existing cement plants had been financed by retained earnings. Some company did not have excess cash and had to rely on commercial bank loans for increasing working capital.

4. Industry's Contribution to National Economy

The contribution to the development of the national economy by the establishment of additional cement plants in the post war period became apparent in several ways. Apart from the conservation of previous dollar's and the amount of taxes paid, the opening of more cement factories provided employment to thousands and made use of the management know-how and technical skills of an expanding increment of wide-awake business executives and technicians. Moreover, the search of ingredients for cement manufacture resulted in the exploitation of prodigious sources of raw materials such as limestone and shale hitherto untapped.

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The stabilization of cement prices as a result of construction of more cement plants was another salutary contribution to the national economy.

The cement industry is one of the well-established industries in the Philippines. In terms of investments, employment and value of sales, it accounts for more than half of the non-metallic mineral industries.

The value of sales of cement in 1963 was P70,604,000. Sales increased by 9% from the previous year's operation.

One of the characteristics of the cement industry is that it is one of the most capital-intensive industries in the country. With a total employment of 2,486 in 1963, the industry has invested in fixed assets a total amount of P104,868,000.-, giving an investment - employment ratio of P42,000 per employee. Salaries and wages paid by the industry in 1963 amounted to P6,216,914.- (except APO) giving an average compensation of P310.- per employee.

Income taxes paid in 1963 was P2,675,823 and this corresponded to an average of 2% of total costs and an average of 3.5% of total sales.

C. Prospects of the Industry

The picture of growth for the industry is presented in the market analysis. The 9.9 million bags extra potential demand for 1963 is believed manifested in the prevailing high retail price for cement. Unless the industry puts up more capacities and increases production, it is very probable that retail price of the commodity would remain in their present levels, if not increase some more. But with more supply, the cost per bag would probably go down, thereby resulting in more purchases and consumption of the products.

The projected demand of 66.3 million bags for 1966 and 88.2 million bags for 1967 were based on the following; (a) condition is assumed particularly on normal prices; (b) the figures are potential demand and not necessarily consumption.

The increased uses of cement can be attributed to the following:

(a) Increasing popularity of concrete hollow blocks in construction activities.

(b) Consciousness on the great relative advantages of concrete roads over other types of road construction appears to be well established in both government and private sectors.

(c) Concept of pre-stressed concrete is slowly and surely gaining ground among architects and builders. The Philippin Pre-Stress Concrete Co., Inc. is the foremost exponent of this concept. On the government side, the Department of Public Works and Communications (Bureau of

Public Highways) is presently constructing its first pre-stress concrete bridge at Rosario, Pasig, Rizal.

With all the cement plants now in the pipeline and planned, there will probably be room in the industry provided an efficient programming system is followed within the next ten years. This is essentially a market-oriented industry and due consideration must be given to the specific markets. Policies will have be directed to the opening of plants at the areas of future construction development.

II. MARKET ANALYSIS

A. GENERAL

The total recorded consumption of cement has multiplied more than fifteen times from 1.6 million bags of 94 lbs. in 1946 to 23.98 million bags in 1961, the peak year so far, in Philippine cement consumption. The following year (1962) total consumption dipped to some 22.7 million bags. The decline was caused by factors discussed further in latter section of this chapter.

The six (6) cement plants in active operation in 1963 are located mainly in Central Luzon and the Visayas. One is located in La Union, having the Northern Luzon area for its "natural" market. Two are located in Central Luzon having the Metropolitan Manila area, Central Luzon, and the Southern Luzon provinces as its sphere of distribution. There are three cement plants in the Visayas; one, with a small capacity, caters to the Western Visayan market. The other two are located in Cebu. Actually, from Cebu City as the distribution center, these two companies have been supplying cement requirements of most the Visayan and Mindanao provinces. Only when Mindanao Cement, located in Ilagan City, goes into operation by about the middle of this year, (1964), shall there be a cement plant in Mindanao.

B. DEMAND

1. Consumption

Table 1 below (together with the chart next page) present the growth picture of the industry. Figures are in bags of 94 lbs.

Table 1[#]

YEAR	PRODUCTION	IMPORTATION	CONSUMPTION
1946	1,341,794	267,739	1,609,533
1947	3,140,548	585,283	3,725,831
1948	2,843,487	2,200,519	5,044,006
1949	5,553,847	2,665,983	8,219,830
1950	6,997,229	1,589,101	8,595,330
1951	7,394,484	292,621	7,687,105
1952	7,756,131	456,230	8,155,895
1953	7,475,856	600,039	9,350,989
1954	7,713,822	1,637,167	10,330,874
1955	9,501,325	829,549	11,840,570
1956	10,443,633	1,396,937	16,005,552
1957	12,524,504	3,481,048	15,936,499
1958	15,313,067	633,432	15,936,499
1959	18,143,535	1,033,277	19,176,812
1960	20,745,489	28,753	20,774,242
1961	23,957,865	21,688	23,979,553

[#] Source: IDC, NEC, PIA

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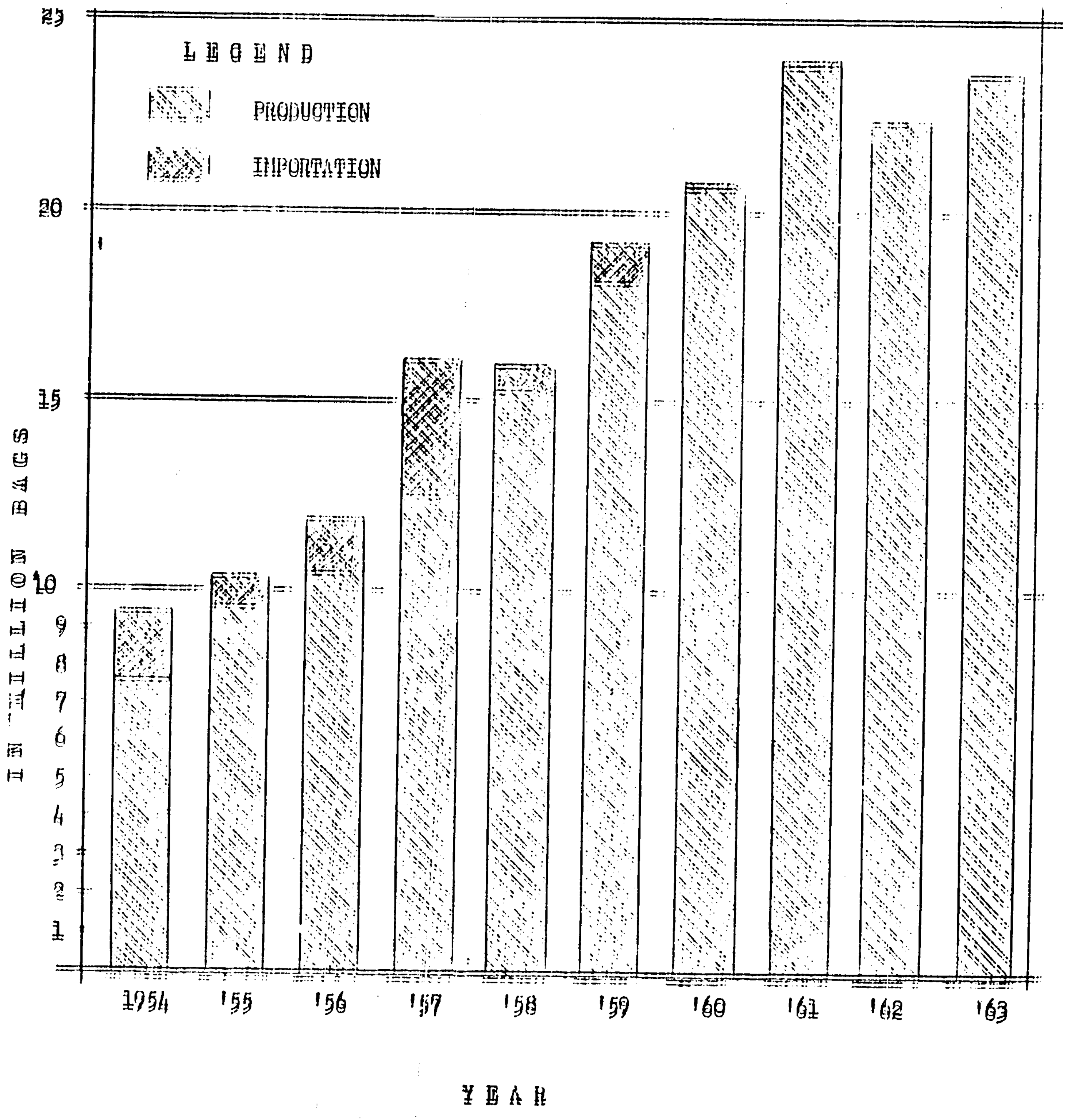
DOMESTIC PRODUCTION, IMPORTATION AND CONSUMPTION OF CEMENT



1962	22,442,000	51,613	22,493,613
1963	23,480,735	458,192*	23,938,927

From the above figures, it will be noted that the increase in consumption presents three distinct patterns. Firstly, for the years 1946-1949, the increase appears to be relatively steep. This is understandable because the country was then undergoing a period of rehabilitation. Secondly, it will be observed that consumption remained steady in 1949-1950 and then dropped below the previous year's level in 1951. The reason behind this is the control on imports which was effected then, such that inspite of increased local production, total cement usage was much lower. The growth trend picked up again in 1952 and continued until 1956, but on a very minimal rate. Thirdly, from the table, it is clear that the 1957 consumption registered a sudden jump over consumption for the preceeding year, and this trend continued till 1961. This behavior of consumption can probably be attributed to the brisk construction activities (both private and public) that ushered in the "construction boom" in the country.

The decline of consumption in 1962 was occasioned by the following factors: first was the drop in supply on account of the failure of Mindanao Cement to operate as scheduled and the dip in production output by Cepoc (About 43% of installed capacity); and second was the drop in construction activity due to the restraints imposed on housing loans and the moratorium on public works expenditures because the different projects were slated for revaluation.

Central Bank

The increase in cement prices indicated a certain degree of shortage because the trend in production costs of cement plants did not justify the price increases. There ensued a situation therefore, of demand-pull rather than cost push. This is shown in table 1-a

Unit Cost of Production
per bag of 94 lbs. of Cement

YEAR	TOTAL SALES *	COST OF GOODS SOLD	UNIT COST
1958	14,985,702	26,592,000	₱1.77
1959	17,040,009	29,212,000	1.71
1960	18,966,078	34,667,000	1.83
1961	23,873,609	41,796,000	1.75
1962	22,534,588	46,748,000	2.07
1963	20,465,004**	38,145,000	1.86

2. Indicator of Demand

Past cement consumption as shown in table 1, is a type of demand indicator based on a historical sense. But the two most important and often considered indicator are:

(i) Cement Intensity Usage as indicated from construction activity, and

(ii) Commodity price, with a base year showing percentage charge.

With respect to the latter, a decrease in price level (considering a base year) is an indicator of oversupply; an increase indicates undersupply.

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* Source: Cement Institute

** for comparability excludes productions of APO cement (formerly CEPOC) because the cost of goods sold figures for 1963 do not include APO.

(i) Cement Intensity Usage

By dividing cement consumed by construction expenditures, a relationship in the form of the quality of cement used per certain amount of pesos spent on construction can be derived. Table 2 below shows the increase in the number of bags of cement consumed per million pesos spent on construction for the last five (5) years 1958-1962).

Table 2- Intensity of Cement Usage
(1958-1962)

Year	Cement Consumption (million bags)	Construction Expenditure (million pesos)	Bags of Cement Consumed/million Pesos of Construction
1958	15.94	722.8	22,053
1959	19.18	753.3	25,461
1960	20.77	826.7	25,124
1961	23.98	847.7	28,288
1962	22.70	776.4	29,237

Source: Program Implementation Agency (OPS)

(ii) Commodity Price (Price Studies)

An examination of Central Bank reports revealed that as of September 1963, retail prices of all commodities in Manila increased by 35% over those of 1955 levels. And using 1955 again as base year, prices of construction materials had reached 140 points, or an increase of 40% for the last eight (8) years. This proves that construction materials are among the costliest of commodities, surpassed only by food items.

Table 3

Retail Price Index of Selected Commodities in Manila

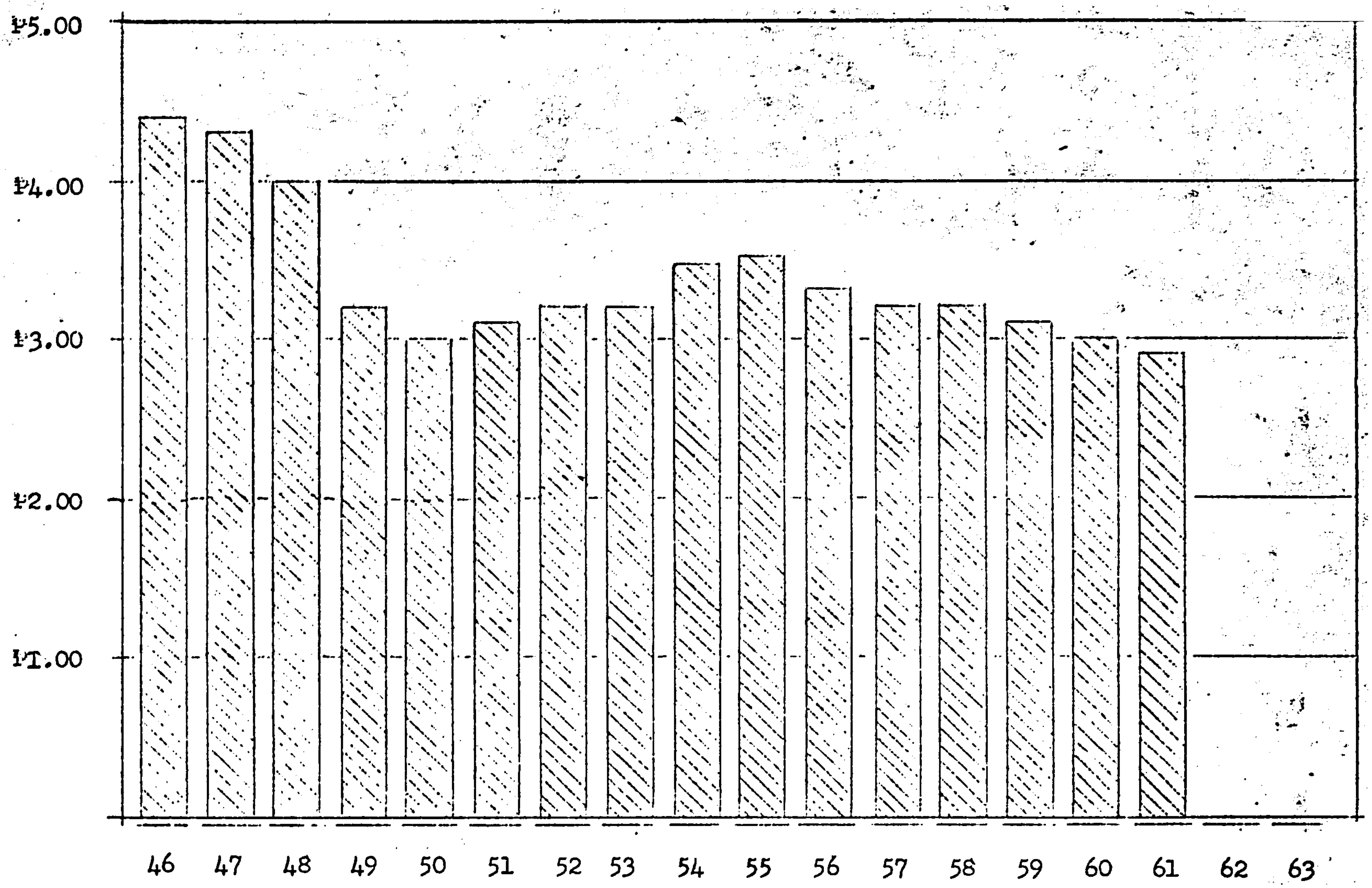
(As of September, 1963, 1955 = 100)

Item	Latest Month	Month Ago	Six Month Ago	Year Ago
Overall	140.2	137.7	134.6	132.9
Food	150.4	143.7	134.6	138.1
Wearing Apparel	138.7	138.7	138.6	13[illegible]
Construction Materials	140.0	140.4	[illegible].8	131.6
Fuel	114.5	114.5	115.2	113.5
Drugs and Medicine	120.7	120.5	120.3	122.9
School supplies	123.8	123.9	123.3	122.5
Beverages and Tobacco	131.0	1[illegible].0	131.0	131.0
Household supplies & equipment	134.4	1[illegible].0	[illegible].9 [illegible]	130.3

Source: Central Bank News Digest, Vol. XV No. 40

A look at the behavior of cement retail prices prevailing all over the Philippines for the years 1960-1963 shows marked increases. (see chart next page). The Manila area showed a rise of almost 100% from ₱2.70 to ₱5.00 per bag. Northern and Southern Luzon showed almost the same percentage increase from ₱3.10 to ₱6.00 per bag. The Visaya and Mindanao areas absorbed a price increase of over 130% per bag. Even ex-Manila warehouse prices increased from ₱2.80 to ₱3.50 per bag, owing perhaps to higher handling, transportation, and storage costs Table 4 shows the details:

AVERAGE PRICE OF PHILIPPINE CEMENT FROM 1946 TO 1961*



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* Source: Cement Institute

Table 4 - Prices per bag of Cement in the Philippines (1960-1963)**

Year	Manila Area	Northern and Southern Luzon	Visayas & Mindanao	Ex-Manila Warehouse
1960	₱2.70 - ₱3.50	₱3.10 - ₱3.50	₱3.10 - ₱3.50	₱2.80
1961	3.30 - 3.60	3.50 - 4.00	3.50 - 4.00	3.00
1962	3.50 - 4.10	4.50 - 5.00	4.50 - 5.00	3.20 - ₱3.30
1963	4.00 - 5.10	5.00 - 6.00	5.00 - 7.00	3.40 - 3.50

**Data furnished by Tayabas Cement Corporation, as checked with retailers.

These price trends try to prove that users of cement, due to undersupply, are willing to pay for the commodity at a premium if only to acquire the product.

3. Forecasts of Demand

In the case of cement, demand forecasts made in the past have mostly been of the trend analysis type, particularly the straight line. In order to determine the method to use in our projections, the following are some relevant discussion:

(i) Trend Analysis

This method presupposes that past consumption figures truly reflect potential demand[*] for the commodity. Projections of this type are shown on Appendix 1-b. In this connection, a review of economic conditions that prevailed during the past years shows that controls imposed on imports after the first crucial years of rehabilitation tended to reduce cement consumption considerably. Since domestic cement production capacities were still limited, importations** had to be made to meet cement needs necessary in the rehabilitation program after the war. With import controls, however, cement importations were discouraged, such that total consumption even decreased in 1951. Moreover, the war scare created by the Korean hostilities seems to indicate that people held on to their "purse-strings," thereby resulting in the suspension of construction plans. These factors created an artificial picture of demand and therefore actual consumption or effective demand cannot be equated with potential demand.

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[*] Potential demand - level of consumption assuming normal market conditions such as normal prices and adequate supply.

In the years that followed, a situation of brisk construction activity occurred and up until 1961 was accelerating at a much faster rate due to more private construction expenditures. But, as explained earlier, Mindanao Cement failed to operate as scheduled, while CEPOC operated at barely 43% of capacity. Consequently, the retail price of cement increased from 1960 to 1963, as a result of undersupply. During the last three years, it is deemed probable, therefore, that consumption of the product could have been greater if prices

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**The DPWC has a pending request to import 600,000 tons of cement from Japan. This volume plus the importation of some 200,000 tons from Taiwan were originally scheduled by the requesting government agencies to be delivered as follows:

	1963	1964	1965	1966
DPWC	3.71 million bags	6.78	5.63	3.75
NPC	0.25	1.41	-	-
NAMARCO	0.84	0.34	-	-
AFP	0.04	-	-	-

were at normal levels. On this account, demand projections based on the straight line method do not reflect potential demand for the product; they tend to be over-conservative.

(ii) Construction Activity

Another method of projection that may be more logical to apply is the one using construction activity as an indicator of demand, thus being considered generally as a more direct measure. As previously discussed, the relationship between cement consumption and construction activity shows the cement usage per certain amount of construction expenditures. Projections based on this method are shown in Appendix 1-c.

In making this kind of demand analysis and projectio, total public and private construction activities were considered. The estimates of total construction expenditures were built up from the working papers of government entities, the report of the World Bank Mission on housing, survey of manufacturers, financial statements of industries, the reports of the General Auditing Office, and statistics of the Department of Agriculture and Natural Resources. It was found out that total construction expenditures would increase by 14.8% annually from 1961. Applying this rate on 1961 apparent cement consumption (1962 is considered an abnormal year because of the decontrol and very low-capacity production of the industry), projected estimates of potential demand for cement (Appendix 1-c) were derived.

The estimates, however, were found to be overly-optimistic. In this case, however, it became apparent that there is no conclusive proof that a given increase in construction expenditure gives rise to a corresponding increase in cement consumption. In fact, it was found that the correlation between the two variables was only 42.5%. Moreover, from interviews with some architects and contractors, it was found out, as hinted before, that price and income elasticities, play a role in cement consumption. Because of high prices and inadequate supply there has been a trend towards an increasing use of substitute durable building materials like abode stones, asbestoes, sheet glass, plastics and aluminum extrutions.

The preceeding discussions prove that using construction activity in calculating the demand for cement, would yield overstated results. It is therefore believed that a method which yields demand estimates more conservative than those derived from correlating construction activity with cement consumption should be used.

(ii) Asymptotic Growth Curve

Giving allowance to the effects of the interplay between economic factors cited above, and showing a point of acceleration of demand without discarding altogether past behavior of apparent consumption, this method is deemed the most applicable. It is believed that forecasts derived thereof would reflect potential demand more logically. The asymptotic projections are contained in table 5 , and supported by a graphical presentation next page. The continuous state of depressed demand due to abnormal market conditions, however, may shift the curve somewhat lower as the years go by. The different projections are compared in appendix 1-c.

Table 5- Forecasts of Potential Demand For Cement in the Philippines , 1963-1967

Year	Potential Demand (million bags)
1963	32.6
1964	40.4
1965	51.2
1966	66.3
1967	88.2

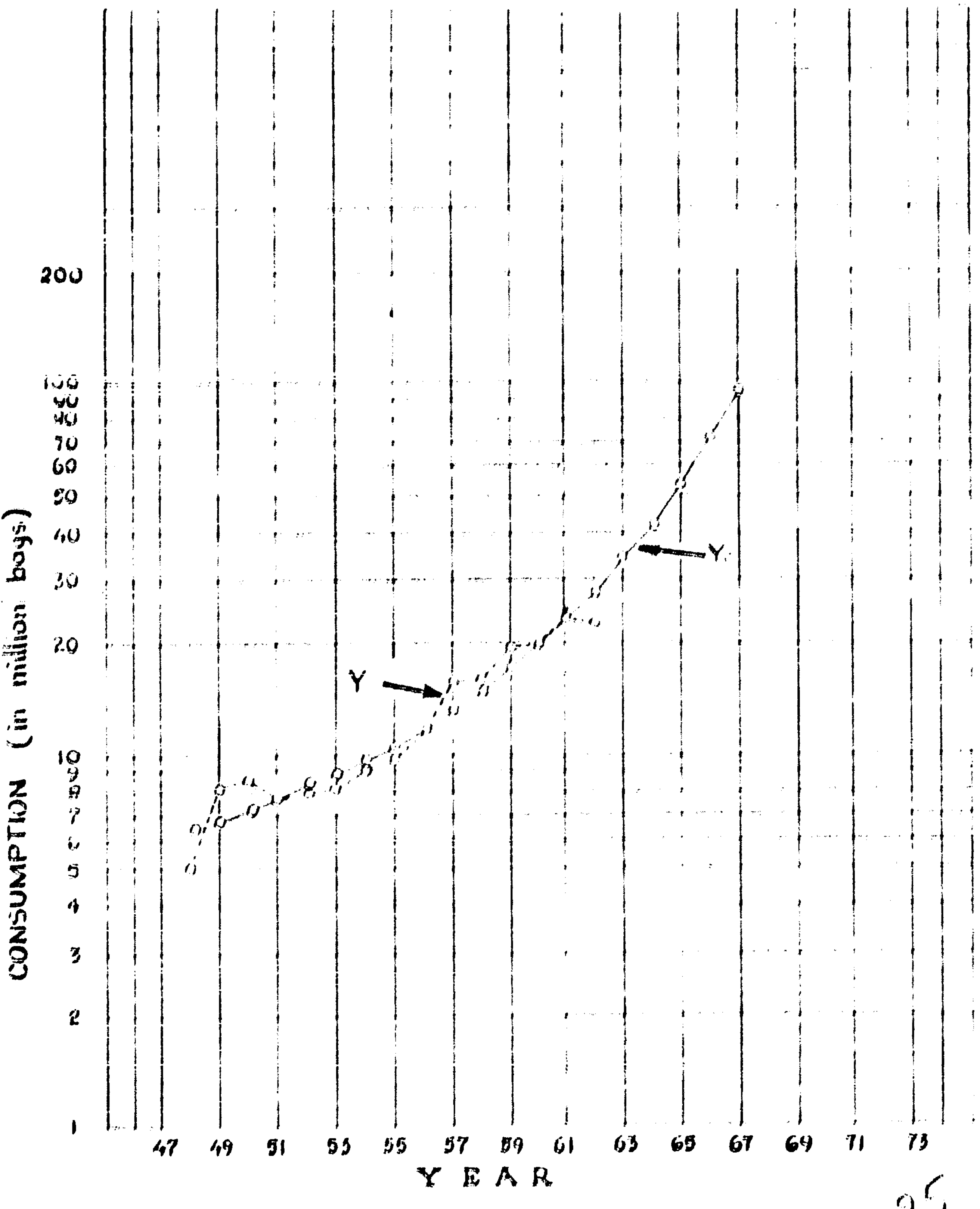
Method Used: $\text{Log}\ Y_c = \log k + (\log a)\ (b)^x$

C. SUPPLY

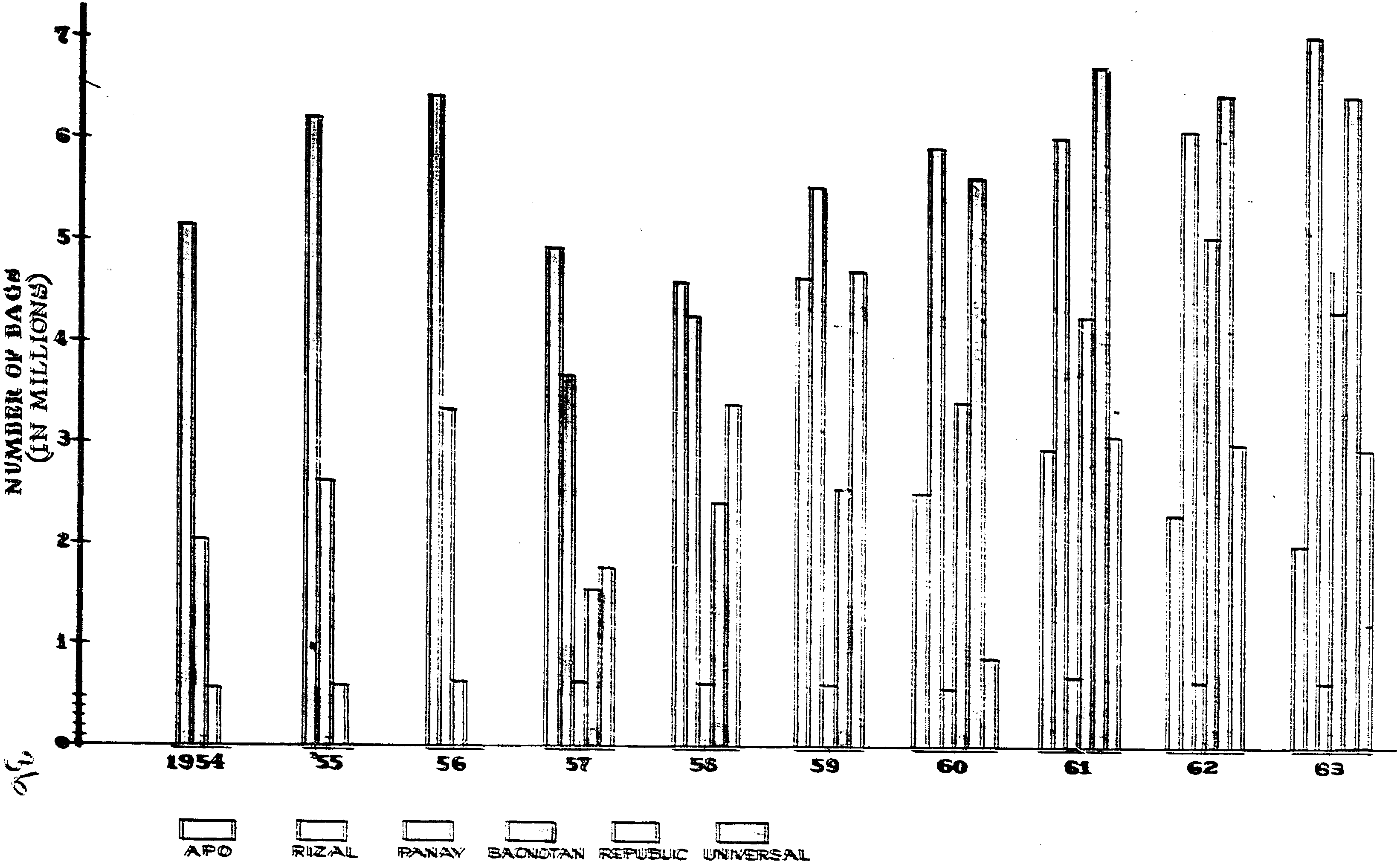
1. Production

Data on individual production of each of the operating plants are shown on the chart next page. Likewise, appendix 1-a depicts the monthly individual sales of each of the operating plants in 1963.

GRAPHICAL PRESENTATION OF ASYMPTOTIC PROJECTIONS OF DEMAND FOR CEMENT



ANNUAL PRODUCTION
# of PHILIPPINE CEMENT — 1954-1963
BY INDIVIDUAL COMPANIES
(IN UNITS OF 94 Lbs. BAGS)



2. Forecasts of Supply

Projections of supply is done on the basis of the existing capacities in the industry, the new plants under construction and on the drawing boards, plus some knowledge of the attainable production levels of some firms. However, in determining surpluses and deficits against total potential demand only the rated capacities of the existing plant and the additional plants which are sure to operate within the projected time period were used. Three additional plants, namely Island (6.6 million bags), Universal Chemicals (3 million bags) and Davao (3 million bags) are not expected to operate until after 1967.

Table 6 - Forecasts of Cement Production
1963-67 (million bags of 94 lbs.)

Existing Plants	1963*	1964	1965	1966	1967
Apo	2.06	4.0	5.1	5.1	5.1
Bacnotan	4.34	5.0	6.0	6.0	6.0
Phil. Portland	0.64	0.7	0.7	0.7	0.7
Republic	6.46	8.0	9.0	9.0	9.0
Rizal	7.02	7.5	9.0	9.0	9.0
Universal	2.96	3.0	3.0	3.0	6.6

---

*Actual Production (source - Cement Institute of the Phil.)

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Expected Additional Plant#

	1963	1964	1965	1966	1967
Mindanao	-	2.0	3.6	4.8	4.8
Filipinas	-	2.7	4.8	6.0	6.0
San Jose	-	-	-	3.0	3.0
Tayabas	-	-	-	4.2	4.2
Luzon	-	-	-	3.0	3.0
	23.48	32.9	41.2	53.8	56.8

#(1) Island, Universal Chemicals and Davao Cement are not certain to operate before 1967.

(2) The list of other proposed plants is found on page 9.

D. MARKET POTENTIAL

For the next five years, unless more capacities are added to the industry, the potential picture of the cement market may take this form:

Table 7 - Market Potential for Cement in the Philippines 1963-1967 (in million bags)

Year	Demand (1)	Supply (2) R. C.	Surplus (Deficit) (1) - (2) at R. C.
1963	32.6	23.48	(9.12)
1964	40.4	32.9	(7.51)
1965	51.2	41.2	(10.0)
1966	66.3	53.8	(12.5)
1967	88.2	56.8	(31.4)

R. C. - Rated Capacity

E. REGIONAL DEMAND AND SUPPLY

One of the major obstacles in undertaking a regional study on cement is the non-availability of data on a regional basis. All reported figures on cement consumption and production are on a national scale.

Considering the rather acute condition of under-supply, a regional study on cement (to be done at a later date) is expected, among other things, to shed light on the following: -

(1) Degree of consumption by the different localities and regions.

(2) The correlation of consumption with industrial activities in the regions.

(3) The priority in cement usage to be given to some areas, assuming a high industrial growth potential owing to the presence of adequate infrastructural projects.

(4) The causes of price differentials, if any.

(5) Economics of transportation.

III. TECHNICAL ANALYSIS

A. PRODUCTION PROCESSES

1. Types of Cement

There are various types of cement. The American Society for Testing Materials (ASTM) classifies portland cement into five types, Types I to V. The greatest bulk of cement locally manufactured is the regular ASTM Type I portland cement and used in general concrete construction. The other types are the moderate heat of hardening Type II, the high early strength Type III, the low heat of hydration Type IV, and the high sulfate resistance Type V. Republic Cement Corporation is the only plant producing types other than Type I. In 1962 it turned out 1½% of its total output with Types II and III.

Any of these 5 types of cement may be added with air-entraining agents to yield concrete of special qualities, particularly resistance to freezing and thawing.

White portland cement is made for special architectural uses and differs from regular cement chiefly in having a very low content of ferric oxide.

All of these types are born from the properties inherent in ordinary portland cement, which high strength and durability actually form the basis for three other types of cement. In short, the level of the quality of ordinary portland cement determine the quality level of the other types of cement.

2. Types of Processes

The "invention " of portland cement by Joseph Aspdin (1779-1855) is said to be the discovery of the fact that cement with high hydraulic property can be made by adding some argillaceous materials to limestone and burning these at a high temperature. This principle remains unchanged even today.

The raw materials for cement consist of about 80% limestone and the others of argillaceous materials. It will take 1.6 tons of raw materials to produce one ton of clinker. In short, the main points in manufacturing cement are:

(1) Access to abundant supply of these high grade raw materials;

(2) Perfect mixing of raw materials for obtaining the proper compositions necessary for giving high strength to cement;

(3) Perfect burning to enable the raw materials to react completely to the chemical changes; and

(4) Maintaining the proper fineness.

In general, grinding, mixing and high-temperature heat treatment are the 3 major processes of the cement manufacturing. Actually there are two types of process used; namely the "Dry=process" and the "Wet=process"; Regardless of the process used; the principal operations involved in cement manufacture are essentially the same: The difference lies in the preparation of the raw materials;

Wet Process: The final grinding and blending are brought about in a water slurry and the mixing is accomplished both in the grinding mills and by stirring in large vats:

Dry Process: All grinding and blending operations are done with dry materials and the final mixing is accomplished chiefly in the grinding mills: A detail description of this process is treated in the next few pages:

The wet process is preferable for dealing with moist raw materials; such as plaster clay; as the clay preparation with such materials presents difficulties: This wet process; moreover; assures more accurate control and mixing of raw materials:

The technical considerations in the selection of a "dry" or "wet" process will therefore depend primarily upon the raw materials and fuel consumption:

Processes used by present plants = The dry process is of more recent origin; and among the operating plants; Republic Cement uses the most modern dry blending process of cement manufacture employing electronic proportioning feeders; suspension type; preheaters; pneumatic blending and convey=

ing and other features. However, the Mindanao Portland Plant is reportedly of more recent design and will need 60 personnel less than the Republic plant based on a same capacity.

The following table show the glaring difference in the use of process among the "old" plants and the new ones.

Wet Process

1.	Rizal	1914
2.	Apo	1922
3.	Phil. Portland	1949
4.	Bacnotan	1954

Dry Process

1.	Republic	1957
2.	Universal	1960
3.	Mindanao Portland	1964*
4.	Filipinas	1964
5.	Tayabas	1966
6.	San Jose	1967

Rated Capacity: Officially, capacity is rated by the number of tons of clinker per day or by the number of bags (94 lbs.) of cement annually based on 300 operating days a year. However, for practical purposes, normal year-in the year-out operations may be expected to average at 80-85% of total rated capacity.

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* The recently installed drier has a rated capacity of 50 ton/hrs and can reduce the moisture content of raw materials from 10-14% H_2O to 3-5%.

Bag Containers: The Luzon Bag Corporation supplies the bag requirements of 5 operating plants - Rizal, Republic, Panay, Bacnotan and Apo. Sales averages 1,600,000 monthly at P0.285 a 4 ply kraft paper bag. Paper is imported in rolls and tubed into shipping sacks. Trade marks are placed accordning to individual specifications. Of interest is the proposed production of kraft from local cellulose sources.

3. Description of a dry process:

Quarrying: The prime raw materials, limestone and shale, are quarried in an area preferably adjacent to the proposed plant site. The stone operation consists mostly of drilling, blasting, loading and transport to the crushing plant. In some cases, shale operation needs only a minimum of drilling and blasting and therefore consists primarily of excavation and transport to the shale crusher.

Crushing of limestone: There are several ways for reducing the stone to a size (about minus 3/8") desirable for the mill. One of the most practical and economical method consists of two stages—a primary jaw crusher which will reduce quarry stone to a nominal size followed by a reversible impactor that will reduce the stone to the desired size without the need of a closed circuit.

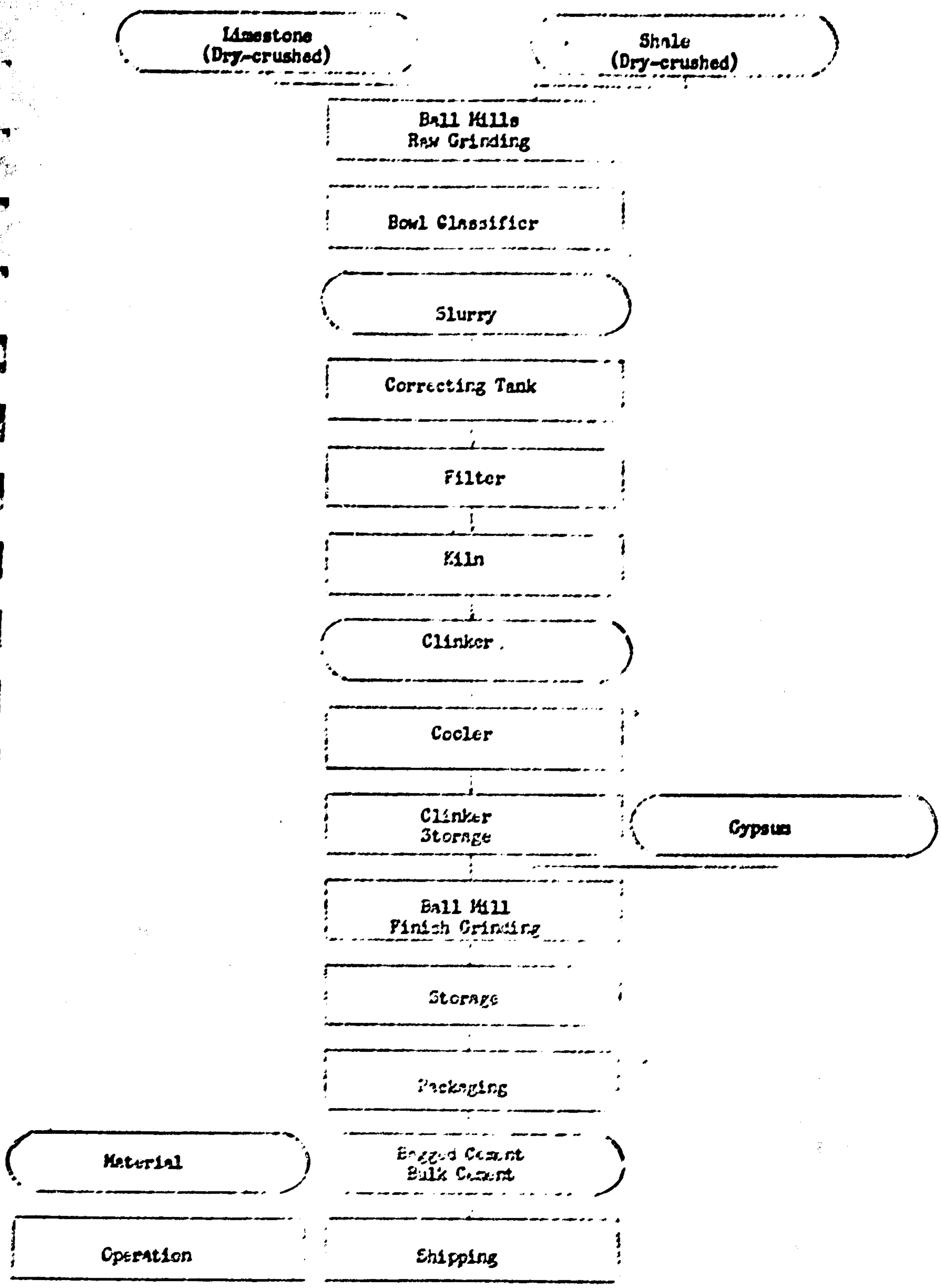
Crushing and drying of shale: A hammer mill is usually utilized to reduce the shale to the desired size. The hammer mill product is then elevated to a small hopper and then directly fed to an oil-fired rotary drier. The dried product is then stored.

The drying plant is designed in such a way that clinker as well as secondary raw materials, can be dried and stored. Separate drying as opposed to closed circuit drying, is recommended in places where unfavorable weather condition exists and where more than 2 basic materials may be used for the raw mix.

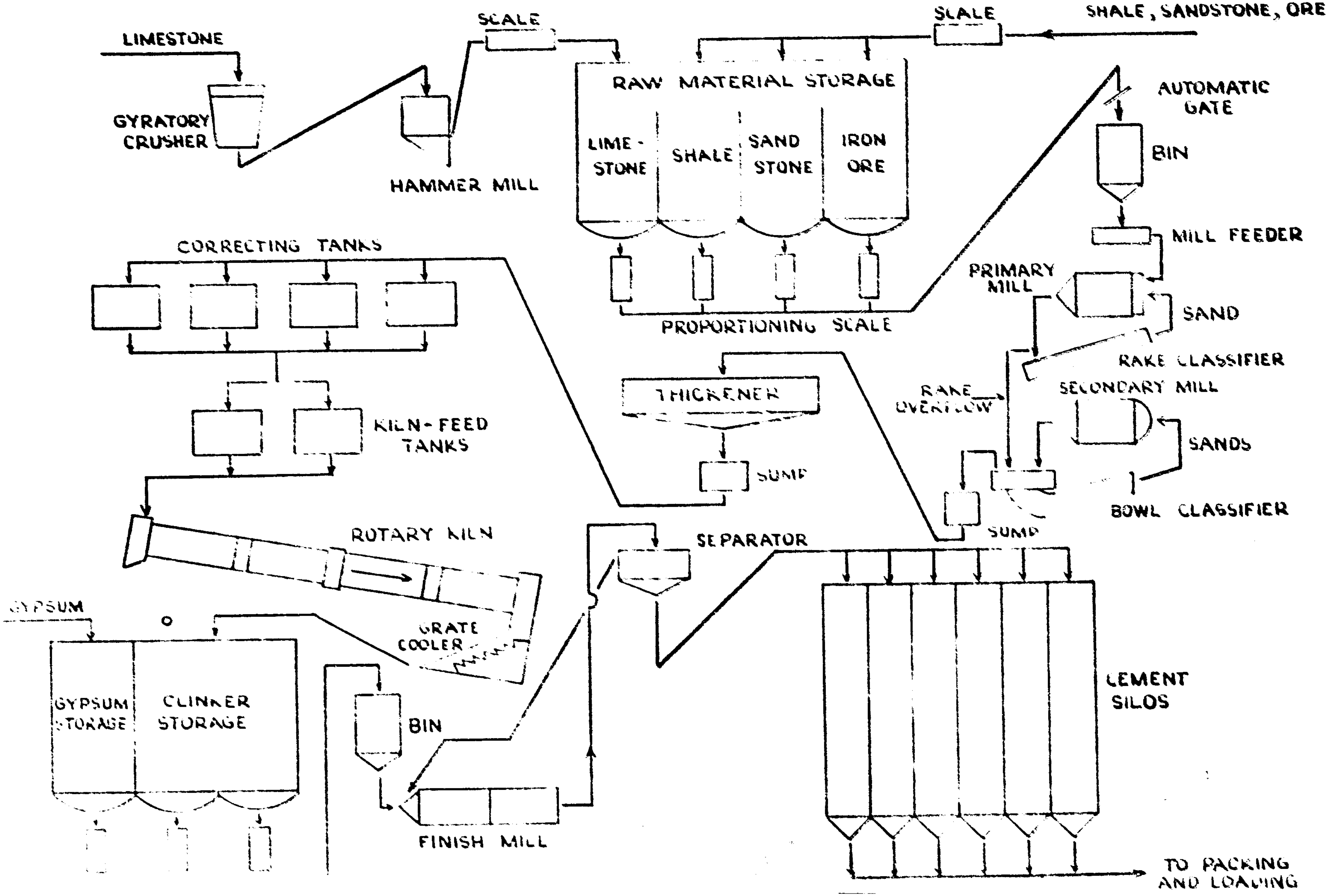
Raw Grinding: The ball mill is provided with four separate feeding elements, since a mixtuer, as designed may require also silica sand and iron ore. The pre-dried and weighed materials are fed directly to the mill and close circuited with a mechanical air separator at the rate of about 250% circulating load. The fines are then pumped to the blending storage.

Blending and Storage of kiln feed: A mechanical circulating system assures proper blending and chemical control of the kiln feed material. In the storage process, a continuous method is employed; one silo receives the separated product and the raw mix continuously discharge by means of weighing-type feeders to the second silo.

TYPICAL FLOW SHEET FOR MANUFACTURE OF PORTLAND CEMENT (WET-PROCESS)



TYPICAL FLOW SHEET OF WET PROCESS PORTLAND CEMENT PLANT



Burning and cooking: Raw materials are burned in a rotary kiln (a steel cylinder sometimes 12 feet or more in diameter) at 1400-1500 C.temperature and are subjected to chemical changes. (The other type of kiln is the shaft kiln). Resulting product is cement clinker. This process is the center of the cemen manufacturing processes.

Finish grinding: The ball mill is usually parallel to and adjacent to the raw mill and will require only two feeding mechanisms - one for clinker and one gypsum. The weighed materials are fed directly to the mill and then circuited with a mechanical air separator. The finished cement is pumped directly from the separator to cement storage silos.

Packaging: Automatic packing machine is used to put the finished product into 94-lb. bags.

New process for cement manufacturing

A new process introduced in Japan a few years ago, and called the "Lime Calcination Process", has been called an epoch-making achievement in the world cement manufacturing history.

In the ordinary cement manufacturing process, limestone, clay and other materials are put in rotary kilns to be calcinated, but with the Lime Calcination Process, first, limestone is pre-calcinated in lime kilns and becomes quicklime, which is added to other materials in the rotary kilns. In this way, the chemical reaction in rotary kilns is more easily and quickly induced than in the ordinary process, and marked production increases of superior and uniform quality cement are attained.

The advantages of this new process which merely involve the installation of lime kilns are economy in heat consumption, increase in production, reduction in electric power, superior quality of cement and high labor productivity.

This process has been adopted for the mass production of high quality and low cost cement.

B. ECONOMIC SIZE OF PLANT

The main factors to be considered, on a technical level, in the installation of cement plant are (a) plant capacity, and (b) number of kilns. All other equipments are based on these two items.

1. Cost of Production

Generally, the cost of production and efficiency of plant operations are more favorable in large cement factories than in small ones. This may be attributed to such factors as the higher mechanical efficiency of large units of machinery and equipments, the better utilization of fuel in large kilns than in small ones and the lower cost of machinery and overhead in large plants per unit output. For instance, the unit cost of production in 1963 of a small-size plants in the Philippines with a capacity of less than a million bags a year was ₱2.80 per bag as compared to ₱1.68 of a 6 million bag-a-year plant.

2. Investment Cost

In 1954, E. Taylor, former manager of CEPOC, stated that "a cement plant, in order to be economically feasible, should have a capacity of at least 4,000 bags of portland cement per 24-hour day". Also, the capital investment for this size of plant was estimated to be about ₱5 million.

The trend these days is for an initial installation of "one unit" cement plant which consists of one kiln with a capacity of about 10,000 bags per day capacity (or about 3 million bags a year) and which has an estimated capital requirement of ₱16,000,000. = . The estimated minimum fixed investment cost per unit capacity in developing countries is shown below:

Minimum Fixed Investment*
(Per Unit Capacity)

Capacity per annum			Fixed Investment		
Tons	or	Bags	Pesos Per Ton	or	Pesos Per Bag
50,000		1,175,000	₱180 = ₱200		₱7.70 ₱8.50
100,000		2,350,000	₱140 = ₱160		₱6.00 ₱6.80
200,000		4,700,000	₱120 = ₱140		₱5.10 ₱6.00
400,000		9,400,000	₱100 = ₱120		₱4.25 ₱5.10

As a basis for comparison, quotations submitted on April 1964 by a major cement manufacturing firm in Japan to PIA show that the estimate for one complete set of equipment and materials for a 500 tons/day (3,525,000 bags/year) cement manufacturing plant, wet process with long kiln, is $2,720,650. = FOB Japan or about ₱11,000,000. = .

3. Breakdown of Investment

Figures taken from a UN publication reveal that the fixed investment of a cement plant can be broken down into:=

(a) Quarry and plant equipment = 50 to 60% of fixed investment for plants without power generation (Quarry equipment is about 5-10% of total)

(b) Building and construction = 30 35%

(c) Miscellaneous . . . . remainder

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* Reference: UN Publication "Studies in Economics of Industries"

Additional 10% may be added for expenses of transport for imported equipment while installation of power generating equipment accounts for 10-15% of fixed investment.

Based on a project study recently evaluated by PIA, the estimates of total project cost are - (a) 58% for machinery and equipments, (b) 30,5% for civil works and machinery installation, and (c) 11,5% for contingencies and other miscellaneous items.

3. Size and Investment Relationship

There is a relation between size and total investment cost. A constant ratio between percentage increase in size and percentage increase in total investment can be derived. A higher ratio is expected if small plants have provisions for future expansion. UN findings, based on recently built plants, show the elasticity factor in 3 major countries:

Germany = 0.64
USSR = 0.66
USA = 0.77

The recent expansion of a relatively modern cement plant in the Philippines to increase production capacity by 50% and with the corresponding capital expenditures indicates that an elasticity ratio of 0,68 could be obtained.

6. LABOR REQUIREMENTS

The labor-capacity relationship points out that labor requirement increases very slightly with the increase of size of plant. The labor output per unit therefore falls sharply as scale increases.

The number of production workers per unit annual capacity in some advanced country can be gleaned from the following table:

Production Workers per 1000 Tons Annual Capacity *

Plant Capacity 1000 tons year	Japan	USSR	USA
100	1.24	-	0.75
200	0.82	1.55	0.48
400	0.62	0.93	0.32
500	0.58	0.78	0.30
1,000	0.54	0.54	0.15

The labor-capacity relationship of the six operating plants in the Philippines shows that the ratio of workers to capacity is relatively very high, as shown below:

Plant A = 1.10	Plant D = 2.04
Plant B = 4.50	Plant E = 1.56
Plant C = 2.68	Plant F = 5.50

For underdeveloped countries, the ideal ratio, assuming 2400 hours per man-year, should be the following:

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* UN Publication, "Studies in Economics of Industry", 1963

Annual Capacity	Number of Workers Required per 1000 Tons
50,000 tons (1 million bags)	1.4 - 1.7
100,000 tons (2 " ")	1.1 - 1.4
200,000 tons (4 " ")	0.9 - 1.2
300,000 tons (6 " ")	0.8 - 1.0
400,000 tons (8 " ")	0.7 - 0.9

Based from the above criterion, only two plants out of the six that operated in 1963 could fall within the range of satisfactory ratio. The rest were 300% off from the desired ratio.

Employees directly engaged in production was 70% of the 2,486 persons employed in the industry in 1963. Cement manufacture requires a high degree of mechanization, thus employment is relatively small compared to the volume of output.

D. UTILITIES

1. Fuel

Fuel consumption is lower in the dry process that in the wet process. Average fuel rate for a wet process cement is around 1,000,000 to 1,300,000 BTU per barrel. On the other hand, the fuel rate of a dry process plant complete with a pre-heater system, averages 600,000 to 700,000 BTU per barrel. The dry process is therefore preferrable if the raw material components are not too sticky or wet.

Statistics from developing countries show that 1.2 million kilo-calories[1] of fuel is required for every ton of dry process cement. The corresponding figure for the wet process is 1.39 million kilo-calories.[2]

The practice in the Philippines, based from data of a local oil company, is that estimated fuel requirement is 1.1 barrel[3] of bunker oil fuel per metric ton of cement (wet process), and 0.75 barrel for dry process. Actual production figures of an operating plant in 1963 reveal that 0.86 barrel of fuel oil was required to produce one metric ton of cement (net process).

2. Power

The differences between the power requirements of indentical plants could be due to several factors, the main of which are:-

(a) Material handling may be manual or mechanical. (The latter uses additional electric power).

(b) Raw material quality. (Hardness or softness of material).

The electrical energy requirements of some advanced countries are:

USA (1957) : : : : : : : : : 129 Kw-Hr. per ton cement
USSR (1959) : : : : : : : : : 100 Kw-Hr. per ton cement
Japan (1959) : : : : : : : : : 138 Kw-Hr. per ton cement

116.35 Kw-Hr. per ton of cement was the energy requirement of one of the plants that operated last year.

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[1] 118,818 liters

[2] 137.650 "

[3] 174.900 "

[4] 119.250 "

E. LOCATION

Location is the first important factor in considering the establishment of a cement plant. Basically, the works should be situated close enough to both the market and the source of raw materials; it should also be within reach of water supply, labor, fuel and transportation.

The selection of areas as possible sites of cement plant are generally predicted by the Bureau of Mines on the following economic factors;

(1) Availability of the limestone and argillaceous material within reasonable distance of each other.

(2) Possible sources of minor raw materials such as gypsum, silica sand and pyrite cinder.

(3) Existence of potential sources of hydro-electric power for operation of plant; availability of coal as fuel for sintering and/or for power

(4) Availability of ample supply of water for mill and camp purposes.

(5) Possible sources of construction materials such as crushed rocks, building stones, and timber.

(6) Weather conditions such as rainfall and typoons.

(7) Adequate soil bearing capacity.

(8) Present transportation facilities to and from the sea.

(9) Distance from market centers of cement.

However, the factors mentioned above have to be based from an economic feasibility studies if a decision has to be reached regarding the exact location of the plant. This was the case of a cement plant (presently under test-run) which decided to physically divide and decentralize its plants into 2 main categories, each with independent plant site. These categories are the Clinker Producing Plant (the first site), and the Finishing Plant (the second site).

The salient features for the decentralization are: *

(1) The expected expenses for pile foundation for a finishing plant on the 1st site and which are depreciable and not bankable, were re-budgeted to partially pay for the land purchased at the second site where the soil bearing capacity is more sound.

(2) The comparative investment cost for the laying of power lines and the readily available power supply in favor of the 2nd site.

(3) The near location of the finishing plant to the market center and the elimination of warehousing problems will give this cement corporation a favorable advantage in serving the patrons and buyers of the finished products.

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* Reference: 1963 Annual Report, Filipinas Cement Corporation

F. MAJOR MACHINERY

1. Breakdown of equipment

A completed set of equipment and materials for a cement manufacturing plant (wet process with a long kiln) is shown below. The estimated percentage costs of each of the equiptment as a ratio of the total cost of equipment as also indicated.

(1)	Raw material quarry equipment	3.5 - 4.0%
(2)	Limestone and clay handling equipment	5.7 - 6.5%
(3)	Limestone and clay conveying equipment	2.5 - 3.2%
(4)	Raw material & clinker storage unit	5.0 - 6.0%
(5)	Raw material grinding, excluding grinding balls	8.0 -12.5%
(6)	Slurry blending equipment	1.8 - 2.5%
(7)	Clinker burning equipment (kiln), excluding electrical precipitator	16 -21 %
(8)	Clinker cooling equipment	7.0 - 9.9%
(9)	Fuel oil firing equipment	1.5 - 2.2%
(10)	Clinker grinding equipment	11.5 - 14.5%
(11)	Cement silo and packaging equipment	3.0 - 4.0%
(12)	Water handling equipment	1.0 -2.0%
(13)	Repair shop equipment	1.3 - 1.8%
(14)	Laboratory equipment	1.0 - 1.3%
(15)	Instruments	5.5 - 6.6%
(16)	Materials	12.0 -15.0%

(a) Electrical precipitators (control)

(b) Grinding balls

(c) Firebricks and castables

The breakdown of the above equipment is found in the Appendix 2-d

2. Advances in technology

Many of the machinery and equipments used are made of steel and of a large scale, because cement manufacturing constantly requires the movement of heavy and bulky materials from the receiving stage of the raw materials to the delivery stage of cement. Moreover, the plant once started will have a continuous 24-hour operation for as long as 5,000 hours at a run. Equipments are now made by manufacturers in standard sizes to fit medium range capacities for world market.

The most prominent features recently noticeable in cement plants are (1) marked tendency for enlarging machinery and equipments, (2) rapid spread of automatic control facilities, and (3) increased use of various meters, for obtaining higher operation accuracy and for rationalizing labor control, and for improving heat effeciency.

Japan, for instance, in availing itself of techniques acquired in the field of boiler manufacture, is turning our long, all-welded kiln for the cement industry. (Kiln shell can be 150-meter long, 3.75 meter in diameter and thickness of 65 mm.) In view of the increasing use of the economically long wet-process kilns, these rotary kilns are built longer with the feed-end sections made larger in diameter to have their section serve as pre-dryers and heater.

G. RAW MATERIALS

1. Composition of Raw Material

The principal components of cement are lime, silica, allumina and iron oxide. These cement-forming oxides are not directly used as such but are generally obtained from raw materials containing such oxides.

These raw materials of portland cement consists principally of:

(1) Limestone or some other lime-containing materials such as marl, chalk or shells, and

(2) Shale or clay or some other argillaceous materials such as volcanic tuffs, ashes and slag.

The raw materials commonly used are more vividly described below:

(1) Limestone is the source of lime; it need not be pure but should contain a low percentage of magnesia and silica. Too much magnesia will cause excessive expansion of hardened cement and free silica is hard to combine chemically unless finely grounded. (Cement rocks are sometimes available in nature. Usually, these cotain the proper proportions of lime, silica, allumina, and iron oxide, By the slight addition of other materials, these could become good raw mixtures).

(2) Shale and Clay. Clay supplies the silica and allumina required and is formed by nature through the weathering of rocks. Shale is clay in solid form and has the same chemical composition as clay.

(3) Additives. (a) silica in beach sand can serve as a corrective additive. Beach sand should however be analyzed for its alkali contents; (b) Pyrite cinder can be added to correct deficiency in iron oxide contents; (3) Waste Bauxite, (d) Artificial products such as blast-furnace slag and precipitated calcium carbonate.

4. Gypsum is used merely to regulate the setting time of cement It is added to the clinker in small amounts which varies from 3 to 5% of the weight of the clinker. As a hydrated sulfate of lime, gypsum is mostly imported abroad.

2. Mineral Reserves & Locations

The Geological Survey Division of the Bureau of Mines, in its latest (August 1963) figures on the limestone deposits of the Philippines as found in Appendix 2-b, shows the volume of reserves and the analysis on 93 location in 36 provinces throughout the country. A reserve of 4619 million tons of limestone deposit was estimated for the 49 sites (out of 93 sites) which were already explored as of last year. The provinces where these deposits are located are the following:

1. Ilocos Norte
2. Mountain Province
3. Cagayan
4. Abra
5. Isabela
6. La Union
7. Nueva Viscaya
8. Pangasinan
9. Tarlac
10. Bulacan
11. Rizal
12. Quezon
13.. Batangas
14. Marinduque

18 Masbate
19 Romblon
20 Or. Mindoro
21 Occ. Mindoro
22 Antique
23 Capiz
24 Samar
25 Leyte
26 Iloilo
27 Negros Occ.
28 Cebu
29 Bohol
30 Surigao del Sur
31 Misamis Oriental

15. Camarines Sur
16. Albay
17. Catanduanes

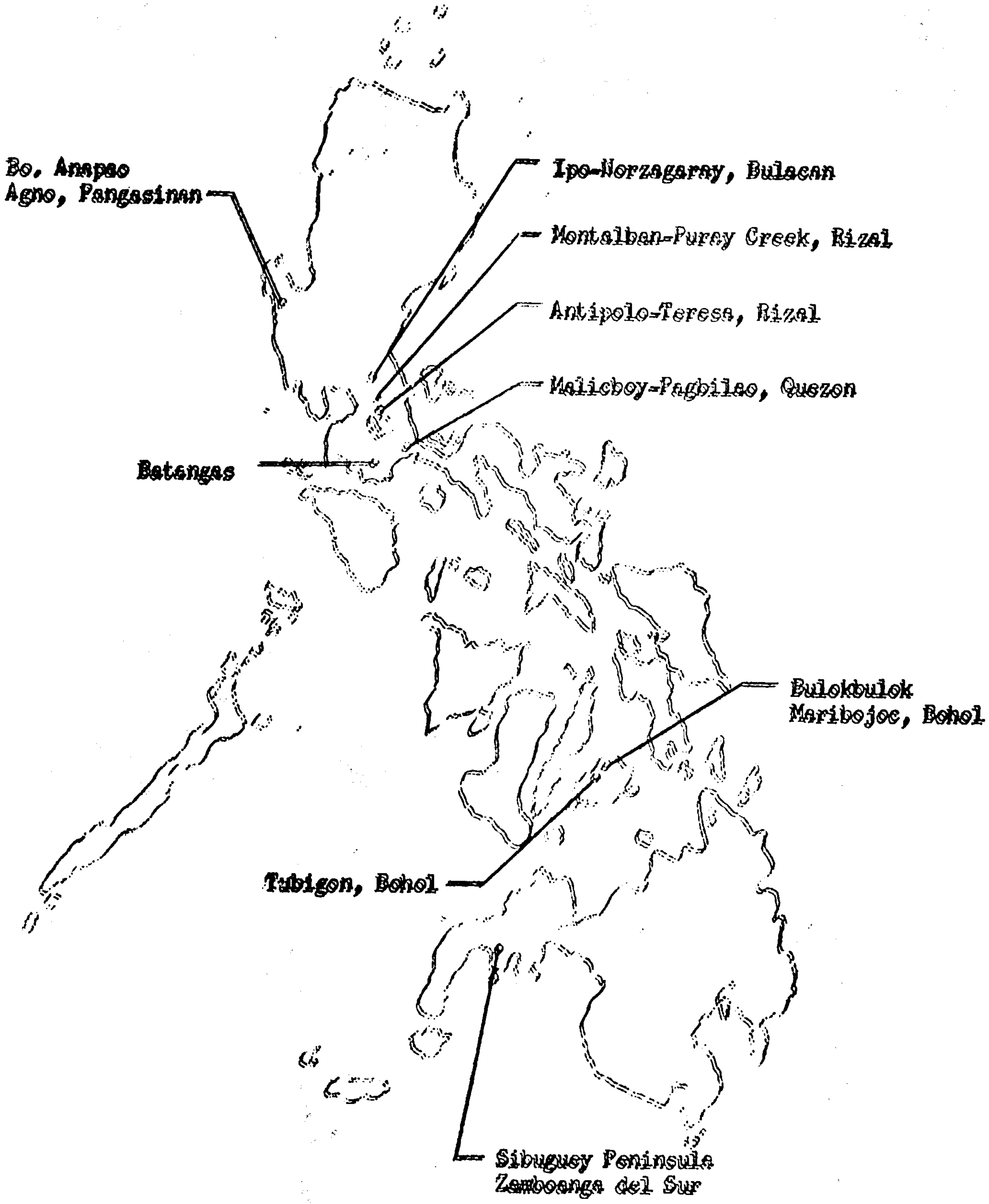
32 Lanao del Norte
33 Zamboanga del Norte
34 Zamboanga del Sur
35 Cotabato
36 Davao

The Republic Cement Corporation is the largest user of gypsum (calcium sulfate) with an annual consumption of 18,000 m.t. Rizal cement requirements are 15,240 m.t. and the other plants in operation bring total annual consumption of 57,240 M.T. Local deposits of gypsum are of insufficient grade to meet cement manufacture standards, although new sources of gypsum are occasionally being reported. Appendix 2-c list down the location and reserves of gypsum. Gypsum is imported from Australia at $12.15 per ton C & F Manila. Other suppliers are in Canada, San Marcos island or Mexico, and Cyprus, Prices fluctuate from $10 to $12.50 MT.

Detail description of eleven sites (previously investigated) which are suitable and where substantial quantities of cement raw materials exist are enumerated in appendix 2-a. These are specifically the (1) Montalban-Puray Creek area, (2) Antipolo-Teresa area, (3) Ipo-Norzagaray Area (Bulacan), (4) Malubay Area (Quezon), (5) Anepao, Agno Area, and (6) Sibuguey Peninsula.

A recent report of the Bureau of Mines list down some 22 sites investigated as well as 9 potential sites for cement plants. The map next page indicates these locations.

* POSSIBLE SITES OF CEMENT PLANTS



* Source: Bureau of Mines

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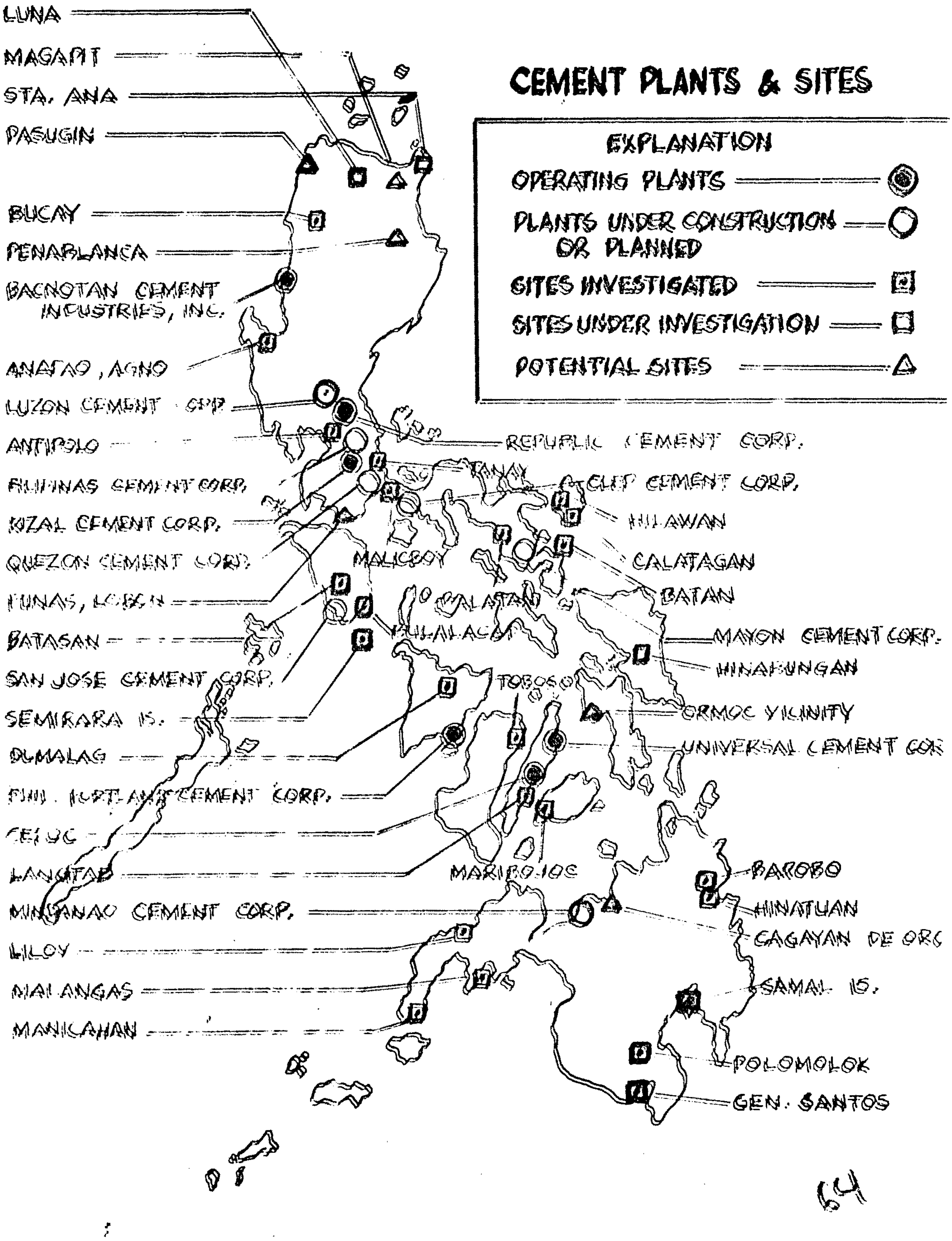
CEMENT PLANTS & SITES



IV. FINANCIAL ANALYSES*

A. GENERAL

1. Operating Plants

This portion of the report presents some basic financial data about the companies presently engaged in this line of undertaking. There were six companies in operation in 1963. Of these companies, four have been in operation before 1958 and the two other companies started operations only during the five-year period of 1958-1962. These six companies are as follows:

Company	Period Covered in this study
Bacnotan	1958 - 1963
Rizal	1958 - 1963
Republic	1958 - 1963
Apo (Cepoc)	1958 - 1962**
Philippine Portland	1960 - 1963
Universal	1961 - 1963

Financial statements for the other cement firms which were under construction as of December 31, 1963 were not considered in this report as they are not yet operational. A thorough analysis is not included in this report due to lack of important detailed information on the financial data available.

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* References: SEC records, annual reports

** APO figures coverage: 1958-1962 only, because figures are unavailable.

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2. Basic Financial Statistics

The basic financial statistics of the cement industry are found in the appendices, pages 92 - 97;

Appendix 3-a - Industry Balance Sheet, 1958-1963
In Thousand Pesos

Appendix 3-b - Industry Balance Sheet, 1958-1963
In Percent of Total Assets

Appendix 3-c - Industry Income Statement, 1958-1963
In Thousand Pesos

Appendix 3-d - Industry Income Statement, 1958-1963
In Percent of Sales

3. Summary of Findings

The industry as a whole is in a very sound financial condition. However, APO (Cepoc), incurred heavy losses in 1961 and 1962. Anothere firm almost broke-even for 1961 and 1962. The other four firms in 1962, made profits over and above the losses of APO (Cepoc). The over-all industry figures in 1963 (excluding APO) still indicate sound financial status:

1. Stockholders' equity as of December 31, 1963 is 45% of the total liabilities and net worth.
2. Yearly stock dividend declarations have been made so that retained earnings comprise only 18% of the total net worth.
3. Total net profits after tax have increased.

	Net Profit After Tax		
	In ₱1,000	% to Sales	% to Net Worth at Beginning
1958	₱ 6,324	15%	20%
1959	8,023	17	21
1960	5,904	11	14
1961	3,131	6	5
1962	4,319	7	6
1963*	11,190	17	24

Other Findings:

1. As of 1963 borrowings, more or less, have been maintained at 55% of total liabilities and net worth, after going down from 62% in 1958.
2. Cash on hand and in banks remained at an average of 3% of total assets.
3. The most affected phase of operations was the collection of accounts receivable. The average collection period was 45 days in 1959 going up to 90 days in 1960 and 80 days in 1961. However, the average collection period for 1962, (excluding APO) was only 30 days.

B. SIZE OF INDUSTRY

The size and growth of the cement industry in the Philippine may be seen in the following table:

---

* APO figures excluded

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	In Thousand Pesos			
	Sales for the Year	% Change	Total Asset at the End of Year	% Change
1958	42,599		98,438	
1959	48,656	9%	109,008	9%
1960	52,593	9	114,133	10
1961	57,823	9	127,398	9
1962	66,105	9	133,837	10
1963	70,604	9	140,139	10

6. PAST TRENDS

1. Sources of Financing

The assets of the industry were financed to a larger portion by borrowing. As of December 31, 1963 financing of the assets of the operating cement firms with the exception of APO came from the following sources:

	In Thousand Pesos	% to Trade
Current Liabilities	₱ 16,689	14%
Long-term Liabilities	48,575	41
Total Liabilities	65,264	55
Common Stock	32,837	27
Preferred Stock	1,432	1
Retained Earnings	19,329	16
Paid-in Surplus	563	1
Revaluation Surplus	-	-
Total Equity	54,161	45
Total	₱119,425	100%

The figures above show that the industry was financed more by borrowing (55%) than by equity (45%).

The sources of financing from 1958 to 1963 are as follows:

Scheme of Financing Expressed as Percentage of Total

	Outside Sources	Reinvested Earnings *	Other forms of Stockholders' Equity
1958	62%	10%	28%
1959	61	11	28
1960	45	12	53
1961	45	10	45
1962	45	8	47
1963	55	16	29

2. Investments

The total investments of the operating firms (except APO) as of December 31, 1963 may be broken down as follows:

	In ₱1,000	% to Total
Cash	₱ 4,104	3%
Trade Accounts Receivable	6,264	5
Inventories	6,797	6
Other Current Assets	11,194	9
Total Current Assets	28,359	24
Property, Plant & Equipment (Net)	88,533	74
Other Assets	2,533	2
Total Assets	₱119,425	100%

3. Cash Position

The cash position of the six firms have been maintained at an average of 3% of total assets from 1958 to 1963:

---

* Excludes stock dividends

	In ₱1,000	% to Total Assets
1958	₱3,535	4%
1959	2,959	3
1960	1,735	2
1961	2,946	2
1962	3,606	3
1963	4,104	3 (excluding APO)

4. Collection Period of Receivables

The length of time required to collect receivables from sales is as follows:

	Days
1959	45
1960	74
1961	90
1962	80
1963	36 (excluding APO)

5. Inventories

Although the six firms have always had low levels of finished goods inventories, (due to high demand) they maintained high levels of inventories of raw materials and supplies. This accounts for the much slower rate of turnover of total inventories compared to the turnover rate of finished goods.

As of December 31, 1963, the total inventories represented 6% of the total assets and 24% of the total current assets.

Year	Number of Times the Finished Goods Inventories were Replenished During the Year	Number of Days Required to Sell Finished Goods
1958	Not Available	Not Available
1959	50 times	7 days
1960	38	9
1961	56	6
1962	70	5
1963 (excluding APO)	57	6

6. Profitability

Sale increased by 55% from 1958 to 1962. Cost increased by 70% during the same period. The percentage increase for the cost is higher than the percentage increase for sales due to the costly operations of the APO (Cepoc) plant. Net profit after tax decreased, correspondingly, in absolute amount or as percentage of total sales. Disregarding APO, sales increased by 14% in 1963, while cost increased by 7% for the same period.

Components of costs as compared with sales revenues are shown below in summarized form:

	1958	1959	1960	1961	1962	1963*
Sales	100%	100%	100%	100%	100%	100%
Less:						
Cost of Sales	63	60	66	72	71	58
Operating Expenses	16	18	19	17	16	18
Other Expenses	4	3	3	3	3	2
Income Tax	2	2	1	2	3	5
Total	85	83	89	94	93	83
Net Profit	15	17	11	6	7	17

---

* Excluding Cepoc

Raw material costs comprise about 15% to 17% of total costs. Power and fuel costs represent about 20% of total costs. Operating expenses should have been lower, if not for the relatively high levels of expenditures of APO (Cepoc), thereby pulling up the average costs.

Net profit as compared with sales and beginning balance of stockholders' equity have decreased. As of 1963 however, an increase in net profit in relation to networth at the beginning was observed from the operating firms except APO.

	Net Profit After Tax	% to Net Worth
1958	₱ 6,324,000	20%
1959	8,023,000	21
1960	5,904,000	14
1961	3,131,000	5
1962	4,319,000	6
1963*	11,190,000	24

All in all, cement manufacture in the Philippines has been a profitable undertaking.

7. Disposition of Net Profit After Tax

Net profit after tax were disposed of as follows:

Year	Total Net Profit	Property Dividend	Cash Dividend	Reinvested in Business	
				As Capital Stock	As Retained Earnings
1958	₱ 6,324	-	₱ 600	₱ 187	₱5,537
1959	8,023	-	1,050	4,463	2,510
1960	5,904	-	3,400	654	1,850
1961	3,131	-	1,200	2,750	(819)
1962	4,319	-	6,203	514	(2,398)
1963*	11,190	307	1,053	829	9,001

---

* APO not included

8. Operations of selected profitable firms (Bacnotan, Republic & Rizal)

Industry figures cited above may not be realistic due to the inclusion of PO (Cepco). Hence, figures pertaining to three selected firms only are presented below.

1. Components of costs as compared with sales revenues:

	1958	1959	1960	1961	1962	1963
Sales	100%	100%	100%	100%	100%	100%
Less:						
Cost of Sales	58	55	61	68	65	58
Operating Expenses	14	18	19	15	17	19
Other Expenses	4	3	4	4	4	2
Income Tax & Bonus	3	2	1	2	2	5
Total	79	78	85	89	88	84
Net Profit	21%	22%	15%	11%	12%	16%

2. Net Profit as compared with sales and beginning balance of stockholders' equity: (Bacnotan, Republic & Rizal figures only)

	In Thousand Pesos				Net Profit as a Percentage of	
Year	Total Assets	Sales	Stockholders' Equity	Net Profit	Sales	Stockholders' Equity (Beg.)
1958	50,914	29,870	18,530	6,188	21%	58%
1959	60,073	33,306	22,821	7,165	22	40
1960	64,563	39,597	27,070	5,871	15	26
1961	67,837	41,731	30,480	4,473	11	17
1962	71,475	47,043	36,622	5,695	12	19
1963	85,021	54,411	39,418	8,753	16	24

D. OTHER RELATIONSHIPS

		1958	1959	1960	1961	1962	963*
1.	Current Assets as percentage of current liabilities	236%	264%	250%	231%	172%	170%
2.	Average Collection Pd. of Receivables	-	45 days	75 days	90 days	80 days	36 days
3.	Inventory Turnover during the year						
	Finished Goods (no. of times)	-	50	38	56	70	57
	Total inventory (no. of times)	-	2	2	3	3	5
4.	Debt as % of equity	162%	155%	83%	80%	81%	120%
5.	Inventory as % of Current Assets	65%	52%	46%	46%	48%	24%
6.	Accounting Rates of Return on Net Worth	20%	21%	14%	5%	6%	24%

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* 1963 figures do not include Cepoc

V. Management and Ownership Analyses

A. Ownership and Present Management

1. Ownership

All of the six operating cement plants, including the Mindanao and Filipinas plants which are set to operate this year, are run by private corporations. (The Cebu Portland Cement Co., (CEPOC), originally government-owned, was taken over by a private management in 1961.)

Of all the eight cement plants expected to operate this year, only the Mindanao Portland Cement can be considered a truly public corporation. It has the widest base having more than one thousand stockholders and this is more diversified as compared to the rest. For instance, Rizal Cement is Madrigal-owned, Republic Cement controlled by Montinola group, Bacnotan by the Del Rosario Group, Universal Cement by the Durano people, Phil. Portland by the Villanueva interest, and the new Filipinas Corporation by a group of construction contractors.

2. Change of Ownership

In 1956, the privately-owned domestic plants are supplying only 38% of the Country's cement requirements. Most of the demand, 54%, was being supplied by government-owned plants and importation was taking care of the remaining 11%. Today the private sector has completely succeeded in changing the picture. The government in 1961 divested itself of all holding in cement and it no longer control the industry.

3. Foreign Participation

The extent of foreign capital participation, expressed is a percentage of total common stock issued and outstanding, indicates that out of the eleven cement corporations (operating and proposed), eight are one hundred percent Filipino capitalization. These are the Philippine Portland, Universal, Rizal, Mindanao Portland, Filipinas, San Jose, Luzon and Tayabas.

The three cement corporations with foreign participation are the following:

(1) Bacnotan:	American	12.72%
	Chinese..........	0.64%
	Spanish	0.06%
	British	0.02%
	Total......	13.44%
(2) Republic:	American	25.61%
	Belgian	1.15%
	Others (British, Chinese, French, Norwegians, Spanish and Swiss)...........	1.55%
	Total	28.31%
(3) Apo	American.........	0.95%

4. Officers of Existing Corporation

The present officers of operating and proposed plants are the following:

(1) Bacnotan Cement:	Filemon C. Rodriguez, President; Ramon V. del Rosario, Executive Vice President; Juan P. Quintos, Vice President-Treasurer; Miguel U. Mananzan, Plant Manager.
(2) Republic Cement:	Aurelio Montinola, President; G. H. Wilkinson, 1st Vice-President; Manuel de Leon, 2nd Vice President; Milton E. Pickup, Treasurer, and Eduardo Taylor, General Manager.
(3) Universal Cement:	Emerito Calderon, President; Edgardo I. Villavicencio, Vice President; Oscar L. Rodriguez, Treasurer and Alfonso E. del Rosario, General Manager.
(4) Rizal Cement:	Vicente Madrigal, President; Simeon R. Paterno, Vice President; Jose P. Madrigal, Treasurer; Consuelo M. Vasquez, Managing Director.

(5) Apo Cement: Cresencio I. Richards, President; Richard J. Bogaski, Executive Vice President; Jose Romero, Jr., Assistant Vice President; Carlos Lopez, Plant Manager.

(6) Philippine Portland Cement: Roberto T. Villanueva, President-General Manager; Gabriel Villanueva, Assistant General Manager; Demetrio Catedral, Plant Superintendent.

(7) Mindanao Portland Cement: Vicente C. Ponce, President; Jose T. Florentino, General Manager.

(8) Filipinas Cement: Eduardo R. Escobar, President; Honrado A. Lopez, Vice President; Marciano D. Bautista, General Manager.

(9) San Jose Cement: Angel J. Santos, President-General Manager; Emeterio R. Ferrera, Vice President-Treasurer.

(10) Luzon Cement: Jose V. Andrada, President; Sixto L. Orosa, Vice-President; Ernesto Mercado, General Manager.

(11) Tayabas Cement: Ignacio Arroyo, President; Ramon C. Pamintuan, Vice President; Honrado Poblador, Jr., Director.

D. Diversification-Expansion Program

The big increase in the production of portland cement

(315% increase over a ten-year period ending December 1963) can only mean that the rate of growth of the cement industry is really phenomenal as compared to other industries.

The expansion program of the operating plants for a two to three-year period reveals a 57% increase in rated capacity from 22.7 million bags in 1963 to 35.7 million bags by 1966.

Republic and Rizal have expanded to increase production capacity by 50% from 6 to 9 million bags. Bacnotan's rated capacity is now up by 3 million bags and Universal will increase its capacity from 3 to 6 million bags by 1966.

Only the Bacnotan Cement is presently engaged in a diversification program. Its expansion-diversification program has been financed entirely out of savings, foreign and domestic credit without equity subscription from stockholders. The program includes the:

(a) operation of Union Steel Products Division in 1963.

(b) increasing rated capacity by 50% by August 1914 by acquisition of another 5600 -bag kiln

(c) export opportunities.

C. Relationship with other Companies

The relationships regarding management, marketing and other aspects show some interesting sidelights in the operation of existing plants.

The following were the observations:

(1) Four out of six operating plants have their own marketing organizations. The other two have exclusive distributing firms, some of the stockholders of which are also stockholders of the cement companies. Republic Cement has Aeon Trading and Theo Davis, and Bacnotan Cement has the Luzon Commodity Corporation.

(2) Rizal, Republic, Bacnotan, Apo and Phil. Portland have financial interest on the Luzon Bag Corporation - producer of cement container bags. The proposal of the Universal Cement to join the corporation is still pending in view of the problem on the nature of privileges which the original subscribers would like to extend to Universal.

(3) One of the major stockholders of the Philippine Prestressed Concrete Co., Inc., aside from the Soriano and AG & P interests, is the Republic Cement group. This Pre-stress Concrete plant started operation in Sept. 1962 and has a targetted sales of P2,500,00 per annum. The cement used by this industry is still insignificant compared to the total consumption for cement.

(4) Some of the top officials of the new cement plants, particularly Republic and Universal, were formerly

connected with CEPOC.

(5) One cement company has controlling interest on the production of some basic raw materials. The Philippine Coal and Coke Corporation and the Universal Gypsum Co., Inc. supply part of the fuel and raw material requirements of the Universal Cement.

(6) The operation of two cement plants are under management contract - Bacnotan Cement by PHINMA and Phil. Portland Cement by the Trans-Philippine Investment Corporation.

D. Trade Association

The Cement Institute of the Philippines (CIP) is an economic and technical research institute whose present membership is composed of six cement companies. These are:

(1) Apo Cement Corporation
(2) Bacnotan Cement Industries, Inc.
(3) Philippine Portland Cement Co., Inc.
(4) Republic Cement Corporation
(5) Rizal Cement Company, Inc.
(6) Universal Cement Company, Inc.

One of its reported main purposes is to pool the resources of the cement industry not only to protect the interests of the industry but, in a wider sphere to seek ways and means by which the industry can share in the development of the nation's economy. Pertinent data on the members are found in the table on the next two pages.

The mission of the CIP, as contained in one of its brochure, are as follows:

1. To conduct technical research work on the manufacture, improvement and uses of cement.
2. To gather and compile literature and data from foreign and local sources regarding the cement industry.
3. To prove and demonstrate the lasting qualities of cement as as building material.
4. To disseminate information on the proper use of cement.
5. To gather and compile statisitcal data on production and consumption.
6. To cooperate with the government in attempting to maintain a sufficiency of cement for the needs of the country.
7. To promote safety practices in the industry.
8. To encourage ethical and fair trade practices.
9. To promote collaboration among the members on certain projects, studies, researches, purchases, and other matters for the collective and individual benefit of the members.
10. To advise ways and means to render the best service to the public.
11. To study the expansion of markets,

The Cement Institute of the Philippines is governed by a Board of Trustees which is composed of ranking officials of the member-companies.

The incumbent members of the Board of Trustees are the following:

(1)	Roberto Villanueva (Phil. Portland Cement, Co., Inc.)	Chairman
(2)	Simeon Paterno (Rizal Cement Co., Inc.)	1st Vice-Chairman
(3)	Ramon V. del Rosario (Bacnotan Cement Industries, Inc.)	2nd Vice-Chairman
(4)	Cresencio Ricahrds (Apo Cement Corp.)	Member
(5)	Hermegildo Serafica (Apo Cement Corp.)	Member
(6)	Juan Quintos (Bacnotan Cement Industries, Inc.)	Member
(7)	Gabriel Villanueva (Phil. Portland Cement Co., Inc.)	Member
(8)	Eduardo Taylor (Republic Cement Corp.)	Member
(9)	Aurelio Montinola (Republic CementCCorp.)	Member
(10)	Gerald Wilkinson (Republic Cement Corp.)	Member
(11)	Consuela M. Vasquez (Rizal Cement Co., Inc.)	Member
(12)	Custodio Villalva (Rizal Cement Co., Inc.)	Member
(13)	Edgardo Villcencio (Universal Cement Co., Inc.)	Member

There is much to be desired in the operation of the CIP. Although it has enumerated a list of objection and functions it is supposed to undertake, yet the activities during the past years were only confined to compilation of demand and supply statistics to serve the interests of its members. It has yet to attain even a foothold on the pace of work undertaken by cement manufacturing associations in other countries.

DATA ON THE MEMBER-COMPANIES OF THE CEMENT INSTITUTE OF THE PHILIPPINES

	Name of Company	Office Address	Plant Address	President	Rated Capacity of Plant, Year	Total Assets	Number of Employees	Process
(1)	APO CEMENT CORPORATION	E-337 Manila Hotel Annex Bonifacio Drive Manila	Naga Cebu	Crescencio Richard	4,000,000	₱20,714,000	450	Wet
(2)	BACNOTAN CEMENT INDUSTRIES INC.	Union Cement Bldg. Bonifacio Drive Port Area, Manila	Bacnotan, La Union	Guillermo Rodriguez	6,000,000	₱24,625,000	240	Wet
(3)	PHILIPPINE PORTLAND CEMENT CO., INC.	Rufino Bldg., Ayala Avenue Makati, Rizal	Guimaras, Iloilo	Roberto Villanueva	720,000	₱4,810,000	178	Wet
(4)	RIZAL CEMENT COMPANY, INC.	6th Floor Madrigal Bldg. Escolta, Manila	Binangonan Rizal	Vicente Madrigal	9,000,000	₱24,026,000	805	Wet
(5)	REPUBLIC CEMENT CORPORATION	3rd Floor Rufino Bldg. Ayala Avenue Makati, Rizal	Norzagaray Bulacan	Aurelio Montinola	9,000,000	₱36,372,000	510	Dry
(6)	UNIVERSAL CEMENT COMPANY, INC.	Durano Bldg. Magallanes St. Intramuros, Manila	Danao, Cebu	Macarito Calderon	3,000,000	₱26,304,000	305	Dry

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APPENDIX 1 = a

SALES OF LOCAL CEMENT COMPANIES*
(In bags)

Year	Month	COMPANIES						TOTAL
		APO	RIZAL	BAGNOTAN	REPUBLIC	PANAY	UNIVERSAL	
1963	JAN	65,728	513,737	385,426	594,795	61,730	239,500	1,860,916
	FEB	138,161	518,541	340,243	554,300	31,238	239,238	1,841,581
	MAR	145,662	654,941	380,843	330,931	55,867	236,344	2,004,588
	APR	221,780	590,273	317,370	539,254	48,564	262,728	1,979,969
	MAY	116,534	614,747	355,163	340,815	56,340	264,755	1,948,374
	JUNE	117,835	604,812	351,572	510,684	57,001	245,851	1,887,755
	JULY	181,765	556,353	328,908	429,141	61,457	212,350	1,769,972
	AUG	=	617,275	364,324	569,779	48,449	218,721	1,800,548
	SEPT	134,362	507,943	347,858	508,006	53,062	197,098	1,748,559
	OCT	228,526	579,146	363,153	507,532	53,032	169,716	1,901,105
	NOV	189,051	575,064	370,314	500,759	42,826	195,257	1,873,271
	DEC	197,399	551,621	308,603	503,133	46,633	143,210	1,750,859
	TOTAL	1,737,311	6,884,453	4,195,777	6,289,129	636,199	2,624,628	22,367,497
1962	TOTAL	2,249,691	6,659,163	4,091,186	6,500,867	662,761	2,976,720	22,534,588
Percentage increase (Decrease) of Sales From Previous Year		=22.8%	≠ 13.6%	≠ 2.5	= 3.2%	= 4.0%	= 11.6%	

REFERENCE: CIP DATA

APPENDIX 1-b Semi-logarithmic Projections
of Demand for Cement

	X	Y(million bags)	log X	X^2	X log Y
1946	1	1.61	0.20683	1	0.20683
1947	2	3.73	0.57171	4	1.14342
1948	3	5.04	0.70243	9	2.10729
1949	4	8.22	0.91487	16	3.65948
1950	5	8.60	0.93450	25	4.67250
1951	6	7.69	0.88593	36	5.31558
1952	7	7.97	0.90146	49	6.31022
1953	8	8.16	0.91169	64	7.39352
1954	9	9.35	0.97081	81	8.73729
1955	10	10.33	1.01410	100	10.14100
1956	11	11.84	1.07335	121	11.80685
1957	12	16.00	1.20412	144	14.44944
1958	13	15.94	1.20249	169	15.63237
1959	14	19.18	1.28285	196	17.9599[illegible]
1960	15	20.77	1.31744	225	19.70160
1961	16	23.98	1.37985	256	22.07760
1962	17	22.70	1.35603	289	23.05251
	153		16.83046	1,785	174.32740
1963	18	31.20	1.49409		
1964	19	35.49	1.55009		
1965	20	40.38	1.60611		
1966	21	45.94	1.66212		
1967	22	52.26	1.71813		

APPENDIX Projections of Demand for Cement

(Based on Present and Estimated Construction Activity)

	Construction Expenditures (X)	Cement Consumption (Y)*
1958	722.8	15.94
1959	753.3	19.18
1960	826.7	20.77
1961	847.7	23.98
1962	776.4	22.71
1963	1,315.9	58.33
1964	1,284.9	55.56
1965	1,476.0	73.08
1966	1,695.5	97.78
1967	1,947.6	129.96

* In million bags of 94 lbs.

N.B. Growth of construction activity was estimated to average 14.87% annually for five years from 1961. It is not known how much would this rate be thereafter.

APPENDIX 1 - d

Computations of Asymptotic Projections of Potential Demand for Cement

	X	Y	Log Y	Computation of Trend Values			
				b^x	(log a)b^x	Log Y_c = log k^c + (log a)b^x	Y_c
1948	0	5.04	0.70243	1.000	.21193	.81662	6.555
1949	1	8.22	0.91487	1.102	.23355	.83824	6.890
1950	2	8.60	0.93450	1.214	.25728	.86197	7.277
1951	3	7.69	0.88593	1.338	.28356	.88825	7.731
1952	4	7.97	0.90146	1.474	.31238	.91707	8.262
Σ_1 log Y			4.33919			4.32215	
1953	5	8.16	0.91169	1.624	.34417	.94886	8.889
1954	6	9.35	0.97081	1.700	.37936	.98405	9.639
1955	7	10.33	1.01410	1.973	.41814	1.02283	10.539
1956	8	11.84	1.07335	2.174	.46074	1.06543	11.626
1957	9	16.00	1.20412	2.396	.50778	1.11247	12.956
Σ_2 log Y			5.17407			5.13364	
1958	10	15.94	1.20259	2.640	.55950	1.16419	14.595
1959	11	19.18	1.28285	2.909	.61650	1.22119	16.642
1960	12	20.77	1.31744	3.206	.67945	1.28414	19.237
1961	13	23.98	1.37985	3.533	.74875	1.35344	22.565
1962	14	22.70	1.35603	3.893	.82504	1.42973	26.899
Σ_3 log Y			6.53866			6.45269	

APPENDIX 1 - e

Demand Projections Based on Index of Consumption

YEAR	PRODUCTION	IMPORTATION	CONSUMPTION	Rate of Increase (decrease) (INDEX OF CONSUMPTION)
1946	1,341,794	267,739	1,609,533	-
1947	3,140,548	585,283	3,725,831	131.5%
1948	2,843,487	2,200,519	5,044,006	35.4%
1949	5,553,847	2,665,983	8,219,830	63.0%
1950	6,997,229	1,598,101	8,595,330	4.5%
1951	7,394,484	292,621	7,687,105	(10.6%)
1952	7,756,131	456,230	7,972,361	3.7%
1953	7,475,856	680,039	8,155,895	2.3%
1954	7,713,822	1,637,167	9,350,989	14.6%
1955	9,501,325	829,549	10,330,874	10.5%
1956	10,443,633	1,396,937	11,840,570	14.6%
1957	12,524,564	3,481,048	16,005,552	35.2%
1958	15,313,067	633,432	15,936,499	(0.4%)
1959	18,142,535	1,033,277	19,176,812	20.3%
1960	20,745,489	28,753	20,774,242	8.3%
1961	23,957,865	21,688	23,979,553	15.4%
1962	22,442,000	259	22,701,000	(5.3%)
	Total			

APPENDIX 1 - f

Comparative Presentation of Potential Demand Projections for Cement (in million bags of lbs.)

Year	Historical (semi-log)	Cement Consumption/ Construction Exp. Correlation	Asymptotic Method	Supply
1963	31.20	58.33	32.6	22.7
1964	35.49	55.56	40.4	32.9
1965	40.38	73.68	51.2	41.2
1966	45.93	97.78	66.3	53.8
1967	52.26	129.96	88.2	56.8

N.B. Our asymptotic projections of potential demand assumed normal conditions.

Suitable Locations For Cement Plants *

(1) Montalban-Puray Creek Area - Limestone and shale which constitute the main raw materials used in cement manufacture abound in this area. The total quantity of limestone available is estimated to be approximately 151,000,000 tons, excluding the limestone deposit between the Montalban hills. The volume of shale at the site is estimated to be around 2,400,000 tons. The limestone found in this area has a high lime content, averaging 54.2% and contains less than one percent of magnesia (Mgo). Gypsum is not found near this area but gypsum deposits with an average of 42% SO_3 are found in the southern part of Batangas. Known coal deposits found nearby are in Liguan, Batan Islands just off Albay province. Semirara Island and Bulalacao, Mindoro.

The Puray and Mariquina rivers would be a good source of fresh water and the proposed Mariquina Rivers Hydroelectric power plant will be a good source of cheap power. Skilled and unskilled labor can be recruited in Manila. The town of Montalban may be reached from Manila by means of a two-lane road passing through the Mariquina Valley.

(2) Antipolo-Teresa Area - The site is only 30 kilometers away from the Manila market. Around 2,000,000 tons of limestone and 20,000,000 tons of calcareous shale are available near the western part of the Teresa valley. Limestone samples analyzed give an average content of 51.1% lime (CaO), 4.46% silica (SiO_2). Its iron oxide (Fe_2O_3) and magnesia (Mgo) contents are low. The limestone available in this area plus the gravel and sand from the Morong river would be good materials for construction. The disadvantages of this site are: (1) Coal and gypsum are not available; and (2) there is not enough water available during the dry season.

(3) Ipo-Norzagaray (Bulacan) Area - The Ipo limestone-shale area is located near the Norzagaray-Ipo dam and is accessible to Manila by means of the Novaliches road. There are at least 300,000,000 tons of limestone in this area and the purity is almost the same as that of the limestone available at Montalban. The limestone contains an average of 55% lime and low percentage of iron oxide (Fe_2O_3) and magnesia (Mgo).

The quantity of shale in this are (Lumbac Valley), including land cultivated with rice, is at least 20,000,000 tons. Chemically, the shale available contains 49 tons to 51% silica and 16.18% alumina. The site may be reached through the Sta. Maria road from Bocaue or through the Angat road from Plaridel. It is proximate to the potential market in Manila and Central Luzon. Cheap power can be purchased from the Meralco and fresh water supply is available from the Angat river.

(4) Malicboy Area (Quezon) - The limestone deposit which is conservatively estimated to contain 57,500,000 tons is located a kilo-

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* Source - Bureau of Mines

meter from Malicboy, Pagbilao, Quezon. The shale area, bisected by a railroad track that runs North-South, is 2 kilometers long and extends 500 meters to the east and west of the track. It is conservatively estimated that around 50,000,000 tons of shale and available.

(5) Northwestern Pangasinan - The best site for a cement plant in Northwestern Pangasinan was found by the Bureau of Mines to be at Barrio Anapao, Agno. The available meterial in this area is a natural cement rock which is slightly deficient in silica. However, this can be corrected by the addition of silica which is obtainable near the Anapao area. The advantages of this site are:

(a) The cement rock deposit is accessible and can easily be quarried.

(b) Fresh water supply can be piped from the Balicanquin river.

(c) Crushed rock, sand, and gravel can be obtained in this area. Building blocks of tuffaceous limestone are being quarried in the nearby area of Bitnong, Mabini. Timber is available in the Northern Zambales range.

(d) The market in Dagupan City and Zambales can be reached either by land or water.

The disadvantages of this site are:

(a) Gypsum, fuel and a potential hydroelectric plant to provide cheap power are not available.

(b) The potential market is small. Dagupan can get its cement needs from Baonotan Cement Industries. Zambales is no longer a big market for cement due to the reduced construction activity in the US Naval Base in this province.

(c) Typhoon occasionally affect this area. The dry season starts in November and ends in April. The six-month rainy season begins in May and ends in October.

(6) Sibuguey Peninsula (Zambaonga del Sur) - The site found to be suitable in this area is under the jurisdiction of Malangas, Kabasalan, Zambaonga del Sur. This site has the following advantages:

(a) It is near the Deplahan-Sutong coal field and only 10 kilometers from the Lumbog coal mine. The plan to open a coke plant in Malangas if carried out will mean cheap coke for the cement plant.

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(b) Fresh water for plant and camp use is available.

(c) It is close to a deep water port.

(7) Bohol - The geological survey made by the Bureau of Mines revealed three suitable sites for a cement plant in Bohol, namely, the Bulok-bulok area of Maribojoc, the Roxas Park in Maambong Garcia Hernandez, and the Kawayanan area in Tubigon. The advantages of the Bulok-bulok area are: (1) There is a supply of fresh water; (2) construction materials such as coral and sand and gravel can be obtained from the Bas Daou Beach and lumber can be taken from the nearby forest; and (3) Maribojoc wharf is only about a kilometer from the possible cement plant and boat comes regularly every week. The disadvantages of this site are: (1) the proposed hydroelectric plant in nearby Tontinan Falls would not be able to develop surplus power for the operation of 2,000-barrel cement plant; (2) there is no available fuel will be used, it has to be imported from abraod; (3) gypsum has to be imported; and (4) silica needed for correcting the mixture is not available.

A sufficient tonnage of shale may be obtained in Roxas Park but silica has to be added to correct the mixture. The availability of highly siliceous clay or quartz vein east and west of Maambong is probable in the light of the geological survey undertaken. Construction materials such as coral and gravel are found on the beach of Garcia Hernandez. The deep-water port of Jagna is about 11 kilometers from the probable cement site. However, this port, unlike the port of Maribojoc, is not in the regular route of inter-island ships.

Sufficient quantities of marl which is nearest in composition to a natural cement rock may be found in Tubigon. If the samples analyzed are representatives of the marl available in the whole area, only a small quantity of silica will be required for correction. Of the three sites, the Tubigon area is nearest to the market in Cebu. However, this site has several disadvantages namely, (1) fresh water is not available in the area; (2) sources of sand and gravel used for construction purposes are far from the site; (3) the marl deposit is four kilometers below the highway and diffioult to reach; and (4) the nearest wharf (Tubigon) is 10 kilometers away and only good for small inter-island boats.

(8) Other - Other sites where substantial quantities of cement raw material exist are:

Site	Estimated Quantities of Available Materials (m.t.)		
	Limestone	Shale	Tuff
Danao, Cebu	136,000,000	4,000,000	-
Naga, Cebu	900,000,000	-	10,000,000
Batangas	500,000,000	250,000,000	-
Lanao (Iligan)	6,000,000	-	-

LIMESTONE DEPOSITS IN THE PHILIPPINES

Compiled by the Geological Survey Division
Bureau of Mines - August 1963

No.	Locality	Analysis % CaO	SiO_2	Al_2O_3	Fe_2O_3	MgO	P_2O_5	N	K_2O	Na_2O	L.O.I.	H_2O	Reserves (in Million M.T.)
L- 1	Ilocos Norte - Burgos	53.66	-	-	-	0.51	-	-	-	-	-	-	-
L- 2	Ilocos Norte - Davila	54.09	-	-	-	0.49	-	-	-	-	-	-	-
L- 3	Mt. Province - Asaweo	-	-	-	-	-	-	-	-	-	-	-	25.0
L- 4	Cagayan - Magapit	50.81	-	-	-	0.80	-	-	-	-	-	-	-
L- 5	C[illegible]yan - Peñablanca	-	-	-	-	-	-	-	-	-	-	-	10.0
L- 6	Abra - Bucay	53.66	0.06	0.16	0.84	0.36	-	-	-	-	-	-	-
L- 7	Isabela - Tumauini-San Pablo	-	-	-	-	-	-	-	-	-	-	-	25.0
L- 8	Mt. Province - Palatte	-	-	-	-	-	-	-	-	-	-	-	3.0
L- 9	La Union - Bacnotan	51.31	2.95	2.62	1.44	0.59	-	-	-	-	-	-	45.0
L-10	Mt. Province - Lagawe, Ifugao	54.94	-	-	-	0.96	-	-	-	-	-	-	-
L-11	La Union - San Fernando, Paro	50.44	3.45	2.43	1.56	0.82	-	-	-	-	-	-	8.7
L-12	La Union - San Fernando, Lingsat	47.92	5.66	2.67	1.97	0.41	-	-	-	-	-	-	3.5
L-13	Mt. Province - Trinidad Benguet	54.94	-	-	-	0.96	-	-	-	-	-	-	-
L-14	Mt. Province - Baguio City	50.31	0.87	0.22	0.68	3.67	-	-	-	-	-	-	-
L-15	Nueva Vizcaya - Bingagan	-	-	-	-	-	-	-	-	-	-	-	25.0
L-16	Pangasinan- Dasol-Bolinao	-	-	-	-	-	-	-	-	-	-	-	44.0
L-17	Pangasinan- Mabini	50.69	6.11	6.08	0.50	0.67	-	-	-	-	-	-	-
L-18	Tarlac - Tarlac, Burgos	52.03	0.45	0.08	0.36	3.48	-	-	-	-	-	-	0.5
L-19	Bulacan - San Ildefonso, Akle	52.75	1.61	0.80	0.60	1.56	-	-	-	-	-	-	40.0
L-20	Bulacan - Norzagaray, Ipo	54.58	Nil	0.37	0.26	0.84	-	-	-	-	-	-	300.0
L-21	Rizal - Sta. Ines	52.75	3.76	0.23	0.41	0.61	-	-	-	-	-	-	-
L-22	Rizal - Montalban	54.20	0.60	0.32	0.52	0.50	-	-	-	-	-	-	151.0
L-23	Rizal - Teresa, Antipolo	51.10	4.50	1.90	1.10	0.70	-	-	-	-	-	-	265.0
L-24	Rizal - Tanay (by Puterce)	52.27	0.02	1.21	0.47	0.97	-	-	-	-	-	-	-
L-25	Quezon - Atimonan	5[illegible].75	-	-	-	0.43	-	-	-	-	-	-	
L-26	Quezon - Malicboy Area	50.30	5.30	3.10	1.20	0.30	-	-	-	-	-	-	157.0
L-27	Quezon - Padre-Burgos Rizal and Pagbilao	51.90	2.73	1.66	0.88	0.66	-	-	-	-	-	-	153.0
L-28	Quezon - Pagbilao, Grande Island	55.51	0.32	0.19	0.16	0.67	-	-	-	-	-	-	-
L-29	Batangas - Rabini, San Jose	39.56	-	-	-	-	-	-	-	-	-	-	1.0

No.	Locality	Analysis (%) CaO	SiO$_2$	Al$_2$O$_3$	Fe$_2$O$_3$	MgO	P$_2$O$_5$	N	K$_2$O	Na$_2$O	L.O.I.	H$_2$O	Reserves (in Million M.T.)
L-330	Camarines Sur - San Fernando	-	-	-	-	-	-	-	-	-	-	-	
L-331	Camarines Sur - Caramoan	-	-	-	-	-	-	-	-	-	-	-	15.0
L-332	Catanduanes - Calolbon	48.48	5.882	3.15	1.60	1.000	-	-	-	-	-	-	10.0
	Catanduanes - Codon	50.777	7.770	0.338	0.48	0.41	-	-	-	-	-	-	1000.0
L-333	Camarines Sur - San Fernando-Bula	-	-	-	-	-	-	-	-	-	-	-	
L-334	Marinduque - Buenavista	-	-	-	-	-	-	-	-	-	-	-	180.0
L-335	Albay - Tapu Tapu, Batan	52.220	2.225	1.992	1.34	2.974							225.0
L-336	Albay - Camalig - Guinobatan	49.772	4.774	2.668	1.12	0.885							-
	Albay - Guinobatan	53.377	-	-	-	0.34							-
	Albay - Camalig	53.377	-	-	-	0.34							10.0
L-337	Romblon - Northern area	-	-	-	-	-	-	-	-	-	-	-	-
L-338	Masbate - Port Barrera	-	-	-	-	-	-	-	-	-	-	-	15.0
L-339	Occidental Mindoro - Alibog												2250.0
	Oriental Mindoro - Bulalacao	53.556	nil	0.390	0.392	0.662	-	-	-	-	-	-	3000.0
L-340	Occidental Mindoro - San Jose	54.995	0.998	1.116	0.880	0.772	-	-	-	-	-	-	-
	Occidental Mindoro - Kamaya	53.556	0.146	1.022	0.488	0.574	-	-	-	-	-	-	-
	Occidental Mindoro - Paclolo	53.996	0.228	0.778	0.488	0.398	-	-	-	-	-	-	-
L-341	Occidental Mindoro - Ilin Island	54.778	nil	0.083	0.392	0.400	-	-	-	-	-	-	120.0
L-342	Antique - Semirara Is., Kapiskapis	51.668	3.886	3.390	1.12	0.662	-	-	-	-	-	-	-
L-343	Antique - Malay-Santander	-	-	-	-	-	-	-	-	-	-	-	15.0
L-344	Antique - Laurila - San Roque	-	-	-	-	-	-	-	-	-	-	-	2250.0
L-345	Capiz - Bolilaw - Ibajay	-	-	-	-	-	-	-	-	-	-	-	390.0
L-346	Samar - Llorente - Borongan	-	-	-	-	-	-	-	-	-	-	-	60.0
L-347	Samar - Guiuan	-	-	-	-	-	-	-	-	-	-	-	10.0
L-348	Iloilo - Dingle area	53.999	-	-	-	-	-	-	-	-	-	-	590.0
L-349	Negros Occidental - Escalante	53.773	-	-	-	-	-	-	-	-	-	-	50.0
L-350	Negros Occidental - San Carlos Escalante	53.225	-	-	-	0.399	0.15	-	-	-	-	-	120.0
L-351	Negros Occidental - Toboso-Magticol	54.477	-	-	1.080	0.883	-	-	-	-	-	-	225.0
L-352	Iloilo - Guimaras Island	34.116	-	-	-	19.117	0.008	-	-	-	-	-	600.0
	Iloilo - Buenavista	41.002	14.598	3.779	1.377	nil	-	-	-	-	-	-	-
L-353	Cebu - Danao - Carmen Area	51.440	2.552	2.771	0.887	1.440	-	-	-	-	-	-	1398.0
L-354	Cebu - Tinaan, Naga	48.444	6.688	3.113	1.225	0.888	-	-	-	-	-	-	-
	Cebu - Tinaan, Naga	28.662	30.992	8.884	2.776	1.110	-	-	-	-	-	-	-
L-355	Leyte del Sur - Maasin	49.499	0.887	0.355	0.644	3.771	-	-	-	-	-	-	3000.0

No.	Locality	Analysis (%)											Reserves (in Million M.T.)
		CaO	SiO_2	Al_2O_3	Fe_2O_3	MgO	P_2O_5	N	K_2O	Na_2O	L.O.I.	H_2O	
L-556	Surigao del Norte-Surigao Island	–	–	–	–	–	–	–	–	–	–	–	30.0
L-557	Bohol – Maribojoc	52.661	–	13.228	0.662	1.399	–	–	–	–	–	–	–
L-558	Bohol – Tagbilaran	52.335	0.992	4.222	1.14	0.440	–	–	–	–	–	–	–
L-559	Surigao del Sur – Lianga-Hinatuan	–	–	–	–	–	–	–	–	–	–	–	90.0
L-560	Oriental Misamis – Lumbia	55.065	–	–	–	–	0.002	–	–	–	–	–	–
L-561	Oriental Misamis – Mandicao-Initarcan	38.224	14.14	–	3.003	1.41	0.002	–	–	–	–	–	10.0
L-562	Iligan City – Aetung	51.881	1.882	2.559	1.339	0.956	–	–	–	–	–	–	–
L-563	Iligan City – Liwalan	47.377	6.660	2.660	1.664	0.883	–	–	–	–	–	–	–
L-564	Zamboanga del Norte-Manukan; L-4887	54.770	0.884	0.377	0.332	1.001	–	–	–	–	39.398	0.227	[illegible]
L-565	Lanao del Norte-Overton-Tubod Area	51.336	6.003	1.14	0.771	0.881	0.009	–	–	–	–	–	5.0
	Zamboanga del Norte-Kauswagan, Liloy; L-4660	53.221	2.330	0.997	0.655	0.377	–	–	–	–	42.550	–	–
L-666	Zamboanga del Norte-Lamonan Cr., Liloy, L-4661	55.442	0.225	2.001	0.377	0.455	–	–	–	–	41.550	–	–
	Zamboanga del Norte-Gingayan Cr. Tugop, Liloy, L-4663	53.333	2.222	1.776	1.332	0.990	–	–	–	–	40.477	–	–
L-667	Cotabato – Mt. Taule	52.956	0.008	0.499	0.881	0.553	–	–	–	–	–		–
	Zamboanga City-Quinipot, Km 3997.1 L-4664	20.440	36.990	14.11	4.227	1.199	2.133	–	–	–	20.553	–	–
L-668	Zamboanga City – Quinipot, Km 3996.1 L-4666	49.177	4.334	2.112	0.332	1.001	0.881	–	–	–	41.366	–	–
L-669	Zamboanga del Sur – Baug	49.220	1.224	2.118	0.884	1.997	–	–	–	–	–	–	–
L-670	Zamboanga del Sur – Cuitanga	49.660	4.009	1.885	0.997	1.14	–	–	–	[illegible]	–	–	500.0
	Zamboanga City – Lubuan-Curuan	–	–	–	–	–	–	–	–	–	–	–	2.0
L-671	Zamboanga City – Bo. Lima, Curuan: L-4617	53.774	1.660	1.04	0.441	0.885	–	–	–	–	42.773	0.266	–
	Zamboanga City-Labuan; L-4882	45.558	7.088	2.393	2.117	0.955	–	–	–	–	37.332	1.333	–
L-672	Cotabato-Awang Area	53.880	0.088	0.499	0.881	0.534	–	–	–	–	37.332	1.333	200.0
	Davao-[illegible]-Bituan	51.446	–	–	–	0.534	–	–	–	–	–	–	500.0
L-673	Davao-Mati	52.663	1.776	0.778	8.881	0.477	0.066	–	–	–	–	–	65.0
	Davao City-Tagbobo Cr. Tagbobo Samal Island; L-4999	42.661	8.778	4.553	1.885	1.889	–	–	–	–	32.773	2.221	–
L-674	Davao City – Magbobo Cr., Tagbobo Samal Island; L-5000	49.557	0.990	0.551	0.444	3.377	–	–	–	–	43.082	0.227	–

	Locality	Analysis (%)											Reserves (in Million M. T.)
		CaO	SiO_2	Al_2O_2	Fe_2O_3	MgO	P_2O_5	N	K_2O	Na_2O	L.O.I.	H_2O	
L-775	Cotabato - Pikit	54.39	-	1.06	0.58	0.40	-	-	-	-	-	-	-
L-776	Cotabato - Matulas-Marbel-Silway	50.95	1.26	0.82	0.97	1.10	0.11	-	0.13	0.88	-	-	1.0
L-777	Cotabato - Koronadal; L-497	39.51	13.92	3.27	1.45	1.16	-	-	-	-	33.36	3.52	-
L-778	Cotabato - Bo. Makilangba, Lumakil Polomolok L-490	53.67	1.54	0.06	0.24	0.67	-	-	-	-	40.63	0.25	-
	Cotabato Bo. Salbuyon, Siguil Gen. Santos; L-492	55.31	0.20	0.09	0.16	0.65	-	-	-	-	41.93	0.07	-
L-779	Cotabato - Bo. Kamilanga, Siguil Gen. Santos L-495	54.76	0.63	0.09	0.24	0.71	-	-	-	-	41.60	0.17	-
	Cotabato - Tufel Hill, Upper Glinan Gen. Santos; L-495	51.36	3.20	0.29	0.32	0.76	-	-	-	-	38.80	0.50	-

GYPSIUM INERAL RESERVES

(As of December 1962)

	PROVINCE	LOCALITY: MUN./ BARRIO/SITIO	OWNED AND/OR OPERATED BY	ESTIMATED RESERVED	GRADE OR ANALYSIS	STATUS	REMARKS
1.	Albay	Bas, Nagas, Tapil		2,000 MT	85% CaSo4 2%		1952
2.	Bahangas	Bahangas, Talanib		500 MT	40% Gypsum		1956
		Mabini, Solo, Panay		33,500 MT	Commercial grade ore 3.64% Beneficiated to 93.1% Gypsum with 933% recovery	Not Operating	1959
3.	Camarines Sur	Nabua, Bo. [illegible]rasan	Madriaga & Co. (Indirect Operator)	10,000 MT	80% Ca So4 2% H_2O or lower		1952
		Nabua, Siramag	Gypsum Mining Co. (1951)	1,050 MT			1952
4.	Negros Oriental	Tagasan, Dalaspan	Suerte Mining Co.	54,062 MT.	84.66%	Prospecting Tunnels	Mr. Arco's Estimate
5.	Negros Occidental	Himamaylan, Carabalan		1,200 MT			1961

SOURCE: BUREAU OF MINES

LIST OF EQUIPMENTS AND MACHINERY FOR A CEMENT PLANT

1. Raw Material Quarry Equipment

    - Hand Drill
    - Portable Air Compressor
    - Diesel Power Shovel

2. Limestone & Clay Handling Equipment

    - Limestone Hopper
    - Primary Crusher
    - Secondary Crusher
    - Belt Conveyors
    - Basket Elevators
    - Clay Hopper
    - Apron Feeder
    - Clay Crusher

3. Limestone and Clay Conveying Equipment

    - Belt Conveyor
    - Tripper

4. Raw Material and Clinker Storage Equipment

    - Electric Overhead Traveling Crane
    - Pyrite Clinker Hopper
    - Belt Feeder
    - Basket Elevator
    - Gypsum Hopper
    - Apron Feeder
    - Gypsum Crusher
    - Chute & Others

5. Raw Material Grinding Equipment

    - Hopper
    - Weighing Feeder
    - Belt Conveyor
    - Raw Material Grinding Mill
    - Slurry Pump
    - Water Pump
    - Electric Hoist
    - Slurry Pipers & Auxiliary Materials

6. Slurry Blending Equipment

    - Slurry Tank
    - Slurry Pumps
    - Slurry Basin
    - Air Compressor
    - Slurry Piper and Auxiliary Material

7. Clinker Burning Equipment

Slurry Feeder and Measuring Tank
Rotary Kiln
Draft Fan
Electric Precipitators
Chimney
Flow Conveyor
Pug Mill
Dust Tank
Cooling Fan
Dust & Auxiliary Materials

8. Clinker Cooling Equipment

Air Quenching Cooler
Cooling Fan
Draft Fan
Cooler Dust & Stack
Pan Conveyor
Belt Conveyor
Multi-Cyclone
Screw Conveyor
Merrie Scale
Chute & Others

9. Fuel Oil Firing Equipment

Oil Burner & Firing Unit
Service Tank
Steam Boiler
Primary Air Fan
Oil Pipes, Chute & Insulated Material

10. Clinker Grinding Equipment

Hoppers
Weighing Feeder
Belt Conveyor
Clinker Grinding Mill
Bucket Elevator
Air Slide
Air Slide Fan
Air Separator
Bag Filter
Induce Fan
Bin
Flow Conveyor
Electric Hoist
Chutes & Auxiliary Materials

11. Cement Silo & Packing Equipment

Cement Silo
Air Slides
Air Slide Blowers
Bag Filters
Flow Conveyor
Bucket Elevator
Vibrating Screen
Surge Bin
Packing Machine
Reversible Belt Conveyor
Portable Belt Conveyor
Bulk Cement Loading Tank
Screw Conveyor
Induced Fan
Truck Scale
Chute and Others

12. Water Handling Equipment

Water Tank
Water Pumps
Water Pipes & Joints

13. Repair Shop Equipment

Lathe with Accessory
Vertical Drilling Machine with Accessory
Sewing Machine with Gear Switch
Bending Roller
Hoist
AC Arc Welder
Flat
Gages
Portable Air Compressor

14. Laboratory Equipment

Compressor Testing Machines
Cement Concrete Physical Testing Instrument
Cement Chemical Testing Instrument

15. Other Instruments

PHLIPPINE CEMENT INDUSTRY
BALANCE SHEET
AS OF DECEMBER 31,1958- 1963
IN THOUSAND PESOS

	1958	1959	1960	1961	1962	1963*
urrent Assets:						
Cash	3,535	2,959	1,735	2,946	3,606	4,104
Accounts Receivable - Trade	4,524	7,574	13,950	15,126	14,351	6,264
Inventories:						
Finished Goods	670	498	424	1,079	253	40
Raw Materials	5,265	4,966	6,780	5,486	6,926	1,664
Others	9,644	9,438	7,325	9,292	10,570	204
Unclassified	704	1,040	1,156	1,853	1,779	4,889
Total	16,283	15,942	15,685	17,710	19,528	6,797
Other Current Assets	891	4,391	2,415	2,723	3,516	11,194
Total Current Assets	25,233	30,866	33,785	38,505	41,001	28,359
roperty, Plant & Equipment:						
Land & Land Improvements	3,810	4,721	5,117	11,915	11,961	1,201
Buildings	6,494	6,649	7,286	10,149	10,808	6,356
achinery and Equipment	23,076	23,870	26,430	37,388	45,371	41,160
Other Equipment	10,319	10,266	8,399	9,182	8,046	8,529
Unclassified	26,957	35,161	37,510	28,489	30,527	45,105
otal	70,656	80,667	84,742	97,123	106,713	101,150
Less: Accumulated Depreciation	16,897	20,524	24,432	28,913	35,797	13,818
Net Book Value	53,759	60,143	60,310	68,210	70,916	88,533
ther Assets	19,446	17,999	20,038	20,683	21,920	2,533
OTAL ASSETS	98,438	109,008	114,113	127,398	133,837	119,425

1963 figures do not include Cepoc.

	1958	1959	1960	1961	1962	1963*
urrent. Liabilities:						
Accounts Payable - Trade	2,985	3,032	4,338	6,544	7,333	4,985
Other Current Laibilities	7,751	9,355	9,592	10,671	17,011	11,704
Total Current Liabilities	10,736	12,387	13,930	17,215	24,344	16,689
ong-term Liabilities						
Deferred Payment Plan	-	1,748	1,270	948	203	-
Loans and Mortgages Payable	39,096	37,313	21,672	21,815	18,204	31,753
Affiliated Company Accounts	-	-	287	672	354	478
Total Long-Term Liabilities	39,096	39,061	23,229	23,435	18,761	32,231
eferred Credits	11,041	14,846	14,612	16,142	16,721	16,344
otal Liabilities	60,873	66,294	51,771	56,792	59,826	65,264
et Worth						
Common Stock	23,374	29,813	47,514	55,974	59,810	32,837
Preferred Stock	3,468	777	1,395	1,355	755	1,431
Surplus Accounts:						
Retained Earnings	11,510	17,073	16,943	16,663	17,701	21,518
Paid-in Surplus	-	564	564	564	564	564
Revaluation Surplus	-	-	-	-	1,898	-
Total	11,510	17,637	17,507	17,227	20,163	22,082
ividends Paid						
Property	-	-	-	-	-	327
Cash	600	1,050	3,400	1,200	6,203	1,053
Stock	187	4,463	654	2,750	514	829
Total	787	5,513	4,054	3,950	6,717	2,189
otal Net Worth	37,565	42,714	62,362	70,606	74,011	54,161
OTAL LIABILITIES AND NET WORTH	98,438	109,008	114,113	127,398	133,837	119,425

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* 1963 figures do not include Cepoc

PHILIPPINE CEMENT INDUSTRY
BALANCE SHEET
AS OF DECEMBER 31, 1958 - 1963
IN PER CENT OF TOTAL ASSETS

	1958	1959	1960	1961	1962	1963*
urrent Assets:						
Cash	4%	3%	2%	2%	3%	3%
Accounts Receivable - Trade	4	7	12	12	11	5
Inventories:						
Finished Goods	1	-	1	1	-	-
Raw Materials	5	5	6	4	5	2
Others	10	9	6	8	8	-
Unclassified	1	1	1	1	1	4
Total	17	15	14	14	14	6
Other Current Assets	1	4	2	2	3	9
Total Current Assets	26	29	30	30	31	24
roperty, Plant & Equipments:						
Land and Land Improvements	4	4	4	9	9	1
Buildings	7	6	6	8	8	5
achinery and Equipment	23	22	23	29	34	35
Other Equipment	10	9	7	7	6	7
Unclassified	28	33	34	23	23	38
otal	72	74	74	76	80	86
Less: Accumulated Depreciation	17	19	21	22	27	12
Net Book Value	55	55	53	54	53	74
Other Assets	19	16	17	16	16	2
OTAL ASSETS	100%	100%	100%	100%	100%	100%

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* 1963 figures do not include Cepoc

	1958	1959	1960	1961	1962	1963*
urrent Liabilities:						
Accounts Payable - Trade	3%	3%	4%	5%	5%	4%
Other Current Liabilities	8	8	8	8	13	10
Total Current Liabilities	11	11	12	13	18	14
ong-term Laibilities						
Deferred Payment Plan	-	2	1	1	-	-
Loans and Mortgages Payable	40	34	19	17	14	27
Affiliated Company Accounts	-	-	-	-	-	-
Total Long-term Liabilities	40	36	20	18	14	27
oferred Credit	11	14	13	14	13	14
otal Liabilities	62	61	45	45	45	55
et Worth						
Common Stock	24	27	42	44	45	27
Preferred Stock	4	1	1	1	1	1
Surplus Accounts:						
Retained Earnings	11	16	15	13	13	18
Paid-in Surplus	-	-	-	-	-	1
Revaluation Surplus	-	-	-	-	1	-
Total	11	16	15	13	14	19
ividends Paid						
Cash	1	1	3	1	5	1
Stock	-	4	-	2	-	1
Total	1	5	3	3	5	2
otal Net Worth	38	39	55	55	55	45
OTAL LAIBILITIES AND NET WORTH	100%	100%	100%	100%	100%	100%

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*1963 figures do not include Cepoc

PHILIPPINE CEMENT INDUSTRY
INCOME STATEMENT
1958 - 1963
IN THOUSAND PESOS

	1958	1959	1960	1961	1962	1963*
t Sales	42,599	48,656	52,593	57,823	66,105	65,214
st of Goods Sold						
Materials	7,450	8,166	6,015	7,173	7,269	2,770
Labor	2,323	2,566	1,142	2,530	2,828	958
Depreciation	1,878	1,874	543	2,696	2,789	526
Others - Overhead	12,043	12,305	3,218	17,314	19,737	9,240
Unclassified Production Cost	1,014	3,624	14,596	-	-	-
Total Production Costs	24,708	28,535	25,514	29,713	32,623	13,494
Inventory Adjustments	1,884	677	1,397	250	3,117	(752)
Unclassified Costs of Sales	-	-	7,756	11,833	11,008	25,403
Cost of Goods Sold	26,592	29,212	34,667	41,796	46,748	38,145
oss Profit	16,007	19,444	17,926	16,027	19,357	27,069
erating Expenses						
Salaries and Bonuses	1,398	1,403	1,355	1,465	1,995	194
Depreciation	96	101	115	129	136	2,300
Others	4,185	5,786	6,129	5,841	6,864	9,258
Unclassified Operating Costs	1,184	1,475	2,514	2,465	2,071	60
Total Operating Expenses	6,863	8,765	10,113	9,900	11,066	11,812
t Profit from Operations	9,144	10,679	7,813	6,127	8,291	15,257
her Expenses (Income)						
Financial	981	848	513	1,215	1,415	344
Others	753	633	836	237	186	742
tal	1,734	1,481	1,349	1,452	1,601	1,086
t Profit Before Bonus and Income Tax	7,410	9,198	6,464	4,675	6,690	14,171
nus	95	116	182	221	541	305
t Income Before Income Tax	7,315	9,082	6,282	4,454	6,149	13,866
come Tax	991	1,059	378	1,323	1,830	2,676
t Income for the Period	6,324	8,023	5,904	3,131	4,319	11,190

*1963 figures do not include Cepec.

ANNEX D

Appendix 3 - d

PHILIPPINE CEMENT INDUSTRY
INCOME STATEMENT
1958 - 1963
IN PERCENT OF NET SALES

	1958	1959	1960	1961	1962	1963*
et Sales	100%	100%	100%	100%	100%	100%
ost of Goods Sold						
Materials	17	17	11	12	11	4
Labor	5	5	2	4	4	2
Depreciation	5	4	1	5	4	1
Others - Overhead	28	25	6	30	30	14
Unclassified Production Cost	3	8	28	–	–	–
Total Production Costs	58	59	48	51	49	21
Inventory Adjustments	5	1	3	–	5	(1)
Unclassified Costs of Sales	–	–	15	21	17	38
Cost of Goods Sold	63	60	66	72	71	58
ross Profit	37	40	34	28	29	42
perating Expenses						
Salaries and Bonuses	3	3	2	3	3	–
Depreciation	–	–	–	–	–	4
Others	10	12	12	10	10	14
Unclassified Operating Costs	3	3	5	4	3	–
Total Operating Expenses	16	18	19	17	16	18
et Profit from Operations	21	22	15	11	13	24
ther Expenses						
Financial	2	2	1	2	2	–
Others	2	1	2	1	–	2
Total	4	3	3	3	2	2
et Profit Before Bonus and Income Tax	17	19	12	8	11	22
onus	–	–	–	–	1	1
et Income Before Income Tax	17	19	12	8	10	21
ncome Tax	2	2	1	2	3	4
et Income for the Period	15	17	11	6	7	17

*1963 figures do not include Cepoc.

Philippine Cement Industry
Estimated Cash Flow Statement
(In Thousand Pesos)

	1959	1960	1961	1962
Cash Receipts:				
Stockholders	3,748	18,319	8,420	3,236
Creditors	-	-	143	-
Collection of accounts receivables/ cash sales	46,606	46,217	56,647	66,880
Others (Disposal of Fixed Assets)	-	-	8,238	-
Total	50,354	64,536	73,448	70,116
Cash Disbursements:				
Raw Materials	7,820	6,523	3,673	7,920
Direct Labor	2,566	1,142	2,530	2,828
Other Manufacturing Expenses	15,929	25,570	29,147	30,745
Operating Expenses	11,830	11,354	7,652	13,439
Capital Expenditures:				
Buildings	155	637	2,863	659
Machinery	794	2,560	10,958	7,983
Land	911	396	6,798	46
Other Fixed Assets	8,151	482	-	902
Repayment of creditors	1,783	15,641	-	3,611
Payment of income tax	991	1,059	378	1,323
Total	50,930	65,760	63,999	69,456
Increase (Decrease) in cash balance during the year	(576)	(1,224)	1,211	660
Cash balance, beginning of year	3,535	2,959	1,735	2,946
Cash balance, end of year	2,959	1,735	2,946	3,606

Philippine Cement Industry
Yearly Increases (Decreases) in Balance Sheet Accounts
(In thousand Pesos)

	Increase (Decrease) 1958-1959	Increase (Decrease) 1959-1960	Increase (Decrease) 1960-1961	Increase (Decrease) 1961-1962	Increase (Decrease) 1962-1963*
Current Assets:					
Cash	(576)	(1,224)	1,211	660	498
Accounts Receivable-trade	2,050	6,376	1,176	(775)	(8,087)
Inventories:					
Finished goods	(172)	(74)	655	(826)	(213)
Raw materials	(299)	1,814	(1,294)	1,440	(5,262)
Others	(206)	(2,113)	1,967	1,278	(10,366)
Unclassified	336	116	697	(74)	3,110
Total	(341)	(257)	2,025	1,818	(12,731)
Other Current Assets	3,500	(1,976)	308	793	7,678
Total	5,633	2,919	4,720	2,496	(12,642)
Property, Plant & Equipment:					
Land and land improvements	911	396	6,798	46	(10,760)
Buildings	155	637	2,863	659	(4,452)
Machinery and equipment	794	2,560	10,958	7,983	(4,211)
Other equipment	(53)	(1,867)	783	(1,136)	483
Unclassified	8,204	2,349	(9,021)	2,038	14,578
Total	10,011	4,075	12,381	9,590	(4,362)
Less: Accumulated Depreciation	3,627	3,908	4,481	6,884	(21,979)
Net Book Value	6,384	167	7,900	2,706	17,617
Other Assets	(1,447)	2,039	645	1,237	(19,387)
Total Assets	10,570	5,105	13,285	6,439	(14,412)

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* 1963 figures do not include Cepoc

Philippine Cement Industry
Yearly Increases (Decreases) in Balance Sheet Accounts
(In Thousand Pesos)

	Increase (Decrease) 1958-1959	Increase (Decrease) 1959-1960	Increase (Decrease) 1960-1961	Increase (Decrease) 1961-1962	Increase (Decrease) 1962-1963*
Current Liabilities:					
Accounts Payable-trade	47	1,306	2,206	789	(2,348)
Other current liabilities	1,604	237	1,079	6,340	(5,307)
Total Current Liabilities	1,651	1,543	3,285	7,129	(7,655)
Long-term Liabilities					
Deferred payment plan	1,748	(478)	(322)	(745)	(203)
Loans and mortgages payable	(1,783)	(15,641)	143	(3,611)	13,549
Affiliated company accounts	-	287	385	(318)	124
Total Long-Term Liabilities	(35)	(15,832)	206	(4,674)	13,470
Deferred Credits	3,805	(234)	1,530	579	(377)
Total Liabilities	5,421	(14,523)	5,021	3,034	5,438
et Worth					
Common stock	6,439	17,701	8,460	3,836	(26,973)
Preferred stock	(2,691)	618	(40)	(600)	676
Surplus Accounts:					
Retained earnings	5,563	(130)	(280)	1,038	3,817
Paid-in surplus	564	-	-	-	-
Revaluation surplus	-	-	-	1,898	(1,898)
Total	6,127	(130)	(280)	2,936	1,919
ividends Paid					
Property	-	-	-	-	307
Cash	450	2,350	(2,200)	5,003	(5,150)
Stock	4,276	(3,809)	2,096	(2,236)	315
Total	4,726	(1,459)	(104)	2,767)	(4,528)
otal Net Worth	5,149	19,648	8,244	3,405	(19,850)
otal Liabilities & Net Worth	10,570	5,105	13,285	6,439	(14,412)

1963 figures do not include Cepoc